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MANAGEMENT OF SAFETY SYSTEMS OF SELECTED ROPE TRANSPORT INSTALLATIONS

UPRAVLJANJE BEZBEDNOSNIM SISTEMIMA IZABRANIH POSTROJENJA UŽETNOG TRANSPORTA

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Abstract: *Ropeway installations such as ski-lifts, cable railways, funiculars, hoisting facilities, personnel lifts, cranes, gantry cranes, lifting installations are subject to the state supervision for safety.*

The nation-wide (Polish) safety management system of ropeway transport safety (PKSBTL) is developed after a long years' research work conducted at the AGH University of Science and Technology in Cracow. The nation-wide Polish system of rope transport safety is divided into several sub-systems:

- *hoisting systems in underground mines,*
- *ski-lift and cableway installations,*
- *passenger and man-material lifts,*
- *other transport facilities, such as cranes,*
- *education, training and certification of personnel.*

Key words: *Ropeway installations,Ttransport safety.*

Apstrakt: *Provera bezbednosti užetnih postrojenja kao što su ski-liftovi, jamske viseće žičare, uspinjače, izvozna postrojenja, pojedinačni liftovi, kranovi, dizalice sa postoljem, dizalična postrojenja, obavlja se pod državnim nadzorom.*

Širom zemlje (Poljske), sistem upravljanja bezbednosti užetnog transporta (PKSBTL) je izrađen nakon dugogodišnjih istraživanja izvršenih na AGH Univerzitetu nauke i tehnologije u Krakovu.
Opšteraširenі poljski sistem bezbednosti užetnog transporta podeljen je na nekoliko pod-sistema:

- *Izvozni sistemi u podzemnim rudnicima,*
- *Ski-lift i postrojena žičare,*
- *Dizalice za putnike, osoblje i materijal,*
- *Drugi transportni objekti, kao što su kranovi,*
- *Obrazovanje, obuka i sertifikovanje osoblja.*

Ključne reči: *Užetna postrojenja, bezbednost transporta,*

1 INTRODUCTION

The AGH –UST has been engaged in research on rope transport for over sixty years. In 1946 well-known specialists: Prof. M Jeżewski, Prof. L. Szklarski, and Z. Kawecki undertook the research work to study the applications of magnetic fields to assessment of wire rope condition. The purpose of their study was to develop a quantitative method of evaluating the technical conditions of bearing ropes in the cable railway Kasprowy Wierch. The method was first applied in 1947 to assess the condition of ropes in cable railways and in 1948 the method was employed – for the first in the world – to assess the condition of bearing ropes in mine hoists. Publications and patents in this field are the major achievements worlwide.

In the following years this branch of studies expanded to become the most important field of diagnostics, which is now called flaw detection. It has been extensively developed both in Poland and abroad. This research work resulted in several Great Doctorate dissertations whilst new technical solutions and novel instruments have been patented both in Poland and abroad.

Since 1992 safety for several years the Department of Rope Transport (AGH-KTL) at the Faculty of Mechanical Engineering and Robotics AGH-UST has undertaken many theoretical and practical studies on safety of technical systems: approximation of the Polish law having relevance to machines safety and technical standards to the EU legislation, control of anthropotechnic systems (man-plant- environment) using safety redundancies, development of safety systems for plants and facilities and formulation of the system management principles.

Since 1994 the secretary office Technical Committee no 163 for Rope and Rope Installations has been affiliated with the Department of Rope Transport.

The major research areas covered by the Committee are: wires and wire ropes, rope drives and their components, equipment for cableway installations and maintenance, cableways, ski-lifts, lifting installations.

In the period 1992-2007 several research projects were completed research programme sponsored by the State Committee for Scientific Research

1 UVOD

AGH – UST se preko šezdeset godina bavi istraživanjem užetnog transporta. Godine 1946. poznati stručnjaci Prof. M Jeżewski, Prof. L. Szklarski, i Z. Kawecki pokrenuli su istraživački rad u cilju proučavanja primene magnetnih polja za procenu stanja žičane užadi. Svrha njihovog proučavanja je bila pronaći kvantitativni metod procenjivanja tehničkog stanja noseće užadi kod jamske viseće žičare Kasprowy Wierch. Ova metoda je prvi put primenjena 1947. da bi se procenilo stanje užadi kod jamskih visećih žičara, a 1948. godine metoda je korišćena – po prvi put u svetu - da bi se procenilo stanje noseće užadi kod jamskih izvoznih mašina. Publikacije i patenti u ovoj oblasti predstavljaju najveća dostignuća u celom svetu.

Sledećih godina ova grana studija se razvila tako da je postala najznačajnije polje dijagnostike, koje se danas zove otkrivanje kvara; razvijala se intezivno kako u Poljskoj tako i u inostranstvu. Ovaj istraživački rad je za posledicu imao nekoliko Velikih doktorskih disertacija, a nova tehnička rešenja i neobični instrumenti patentirani su i u Poljskoj i u inostranstvu.

Već nekoliko godina, od 1992. godine Odsek za užetni transport (AGH-KTL) na Fakultetu za mašinstvo i robotiku AGH UST pokrenulo je mnoge teoretske i praktične studije o bezbednosti tehničkih sistema: harmonizacija zakona Poljske koji se odnose na bezbednost mašina i tehničke standarde sa zakonodavstvom EU, nadzor antropotehničkih sistema (čovek-postrojenje-okolina) uz pomoć redundantnosti u oblasti bezbednosti, razvoj bezbednosnih sistema za postrojenja i kapacitete i formulisanje principa upravljanja sistemima.

Od 1994. godine sekretarijat Tehnička Komisija br. 163 za Užad i užetna postrojenja pridružen je Odseku za užetni transport.

Glavne oblasti istraživanja koje je Komisija obavljala su: žice i žičana užad, užetni pogoni i njihove komponente, oprema za žičarska postrojenja i održavanje, jamske viseće žičare, ski liftovi, dizalična postrojenja.

U periodu od 1992.-2007. godine okončano je nekoliko istraživačkih projekata – istraživački program pod pokroviteljstvom Državne komisije

(KBN), doctor's theses were successfully defended and many jobs for the industrial sector were accomplished. The results were presented during the 12 international conferences and 13 symposia organised by the Department of Rope Transport in collaboration with:

- State Mining Authority (WUG) in Katowice,
- Technical Inspection Office (UDT) in Warsaw,
- Transport Technical Inspection (TDT) in Warsaw,

and other organisations.

Those attending the conference were experts from several countries and conference materials were published in 41 AGH-KTL Journals (ISSN 1640-4351).

2 MAJOR ACHIEVEMENTS OF THE DEPARTMENT OF ROPE TRANSPORT IN THE FIELD OF SAFETY OF MACHINES AND INSTALLATIONS:

- formulation, definition and starting a public discussion on terms relating to hoist transport safety (safety redundancy, safety level, acceptable risk level),
- identification and definition of 12 types of safety redundancies (structural, functional, parametric, time-related, informational, diagnostic, cognitive, qualitative, systematic margins and those involving resistance features, safety measures and human reliability),
- development of the safety control methodology using the safety redundancies,
- development of reporting procedures and occupational risk assessment procedures for mine hoist operators,
- development of the nation-wide mine hoist safety management system, covering the safety of hoisting operations,
- framework for the creation of the computer system supporting the mine hoist safety management system,

za naučna istraživanja (KBN), uspešno su odbranjene doktorske teze i okončani su mnogi radovi u privrednom sektoru. Rezultati su predstavljeni tokom 12 međunarodnih konferencija i 13 simpozijuma koje je organizovao Odsek za užetni transport u saradnji sa:

- Državnim nadzornim organom za rudarstvo (WUG) u Katovicama,
- Upravom za tehnički nadzor (UDT) u Varšavi,
- Službom za tehnički nadzor transporta (TDT) u Varšavi,

i drugim organizacijama.

Konferenciji su prisustvovali eksperti iz nekoliko zemalja a konferencijski materijal je objavljen u Časopisu (41) AGH-KTL (ISSN 1640-4351).

2 GLAVNA DOSTIGNUĆA ODSEKA ZA UŽETNI TRANSPORT U DOMENU BEZBEDNOSTI MAŠINA I POSTROJENJA:

- Formulisanje, definisanje i pokretanje javne diskusije o uslovima vezanim za bezbednost izvoznog transporta (redundantnost u oblasti bezbednosti, nivo bezbednosti, nivo prihvatljivog rizika),
- Utvrđivanje i definisanje 12 vrsta bezbednosnih redundanci (strukturne, funkcionalne, parametrične, vremenske, informacione, dijagnostičke, kognitivne, kvalitativne, sistematične granice i granične vrednosti koje obuhvataju osobine otpora, bezbednosne mere i odgovornost čoveka),
- Razvijanje metodologije kontrole bezbednosti pomoću bezbednosnih redundanci,
- Razvijanje postupaka izveštavanja i postupaka ocene profesionalnog rizika za osoblje koje radi na jamskim izvoznim mašinama,
- Razvijanje širom zemlje sistema za upravljanje bezbednošću jamskih izvoznih mašina, koji obuhvata i bezbednost rada izvoznih mašina,
- Okvir za izradu kompjuterskog sistema za podršku sistema upravljanja bezbednošću jamskih izvoznih mašina,

- formulating the principles of data acquisition for the nation-wide mine hoist safety system [1, 2].

- Formulisanje principa prikupljanja podataka širom zemlje za bezbednost jamskih izvoznih mašina [1, 2].

3 ROPEWAY TRANSPORT SAFETY SYSTEM IN POLAND

3.1 CHARACTERISTICS OF THE SYSTEM AND ITS BASIC RESOURCES

- The mission of the vertical transport safety system in Poland – a non-profit organisation- is to ensure the constant improvement of the safety conditions of cable railways, ski-liftsm chair-lifts, mine hoists, lifts designed to carry persons, material lifts, cranes and other ropeway installations.

3 BEZBEDNOSNI SISTEM ZA UŽETNI TRANSPORT U POLJSKOJ

3.1 KARAKTERISTIKE SISTEMA I NJEGOVI OSNOVNI RESURSI

- Zadatak bezbednosnog sistema za vertikalni transport u Poljskoj–neprofitne organizacije – jeste da obezbedi stalno poboljšanje uslova bezbednosti jamskih visećih žičara, ski liftova i dizalica sa jednim sedištem, jamskih izvoznih mašina, dizalica namenjenih za prevoz lica, dizalice za materijal, kranovi i druga užetna postrojenja.

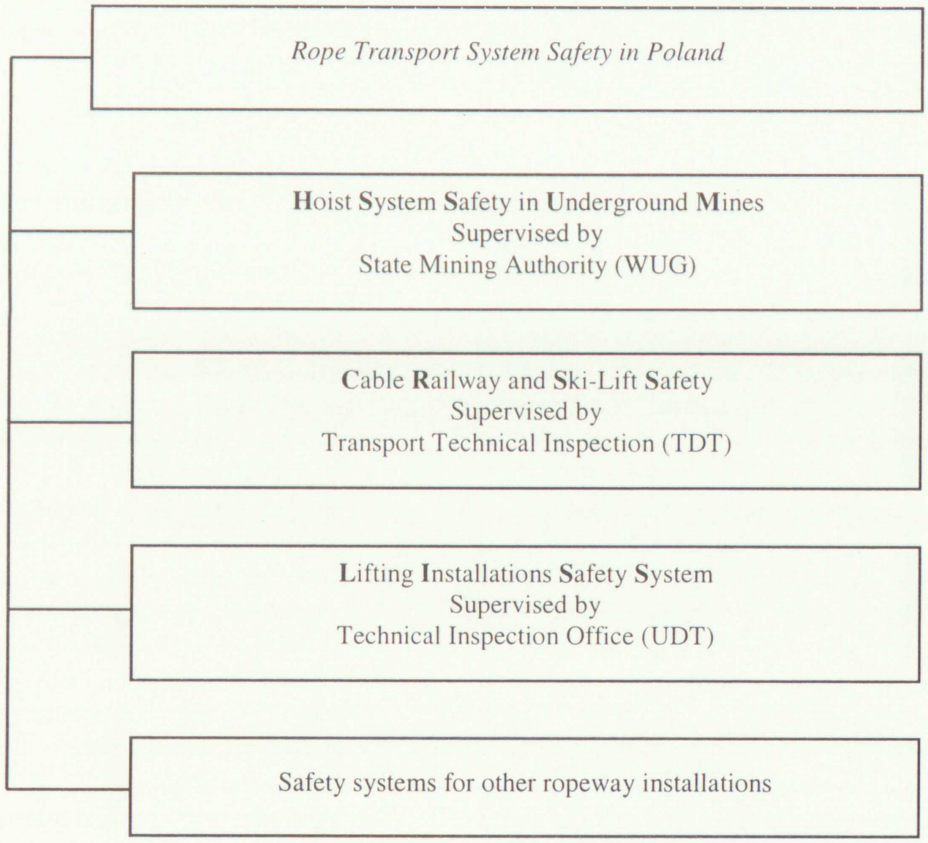

Figure 1 Division of the rope transport safety system in Poland into sub-systems [3, 4]
'ika 1 Podela bezbednosnog sistema za užetni transport u Poljskoj na pod-sisteme [3, 4]

- The system makes use of the existing organisational, human, material and information resources being at the disposal of all bodies responsible for safety conditions, including:

- Sistem koristi postojeće organizacione, ljudske, materijalne i informacione resurse koji su na raspolaganju svim telima odgovornim za uslove bezbednosti, uključujući:

- EU and Polish legislation and standards,
- State agencies responsible for safety conditions (not only in the mining sector): State Mining Authority (WUG), State Labour Supervision, Office of Technical Inspection (UDT), Technical Inspection in Transport (TDT), Polish Committee for Standardisation (Technical Committees) PKN (KT) and others,
- Research and development units, universities with their research facilities,
- Organisations dealing with design, manufacture, operation, maintenance and testing of mine hoist components,
- Certified laboratories and units, control agencies,
- Individuals.

– Integration of all the interested parties (with their organisational and human resources) in the system ought not to be obligatory, instead they should fully accept the optimal institutional, technical and financial solutions in the given conditions.

– The motivation to accede to the system and accordingly conform to the imposed requirements should stem from their desire to ensure social, technical and economic benefits to the supervision agencies, manufacturers, operators, safety inspection. Furthermore, they need to be convinced that the requirements imposed by the system help to achieve the basic goals (i.e. the mission).

– In order to ensure effective functioning of the system it is required that all institutions making and enforcing the law having relevance to rope and rope transport installation safety, including the State Mining Authority Technical Inspection Office, Transport Technical Inspection, fully approve of the system.

– The system provides:

- procedures enforcing the improved safety standards,
- cooperation between research and development units and other organisations, such as: State Mining Authority, State Labour Supervision, Office of Technical Inspection, Technical Inspection in Transport, Polish Centre for Testing and Certification, Polish Committee for Standardisation (Technical Committees),

- Zakonodavstvo i standardi EU i Poljske,
- Državne agencije odgovorne za bezbednosne uslove (ne samo u rudarskom sektoru): Državni organ nadzora za rudarstvo (WUG), Državni nadzorni organ za rad, Uprava za tehnički nadzor, (UDT), Služba za tehnički nadzor transporta (TDT) Poljska Komisija za standardizaciju (Tehničke komisije) PKN (KT) i druge,
- Odeljenja za istraživanje i razvoj, univerziteti sa svojim istraživačkim kapacitetima,
- Organizacije koje se bave projektovanjem, izradom, rukovanjem, održavanjem i ispitivanjem komponenata jamskih izvoznih mašina,
- Sertifikovane laboratorije i odeljenja, agencije za kontrolu,
- Pojedinci.

– Integrisanje svih zainteresovanih strana (sa njihovim organizacionim i ljudskim resursima) u sistem koji ne bi trebalo da bude obavezujući, već u kome bi oni u potpunosti prihvatali instituciona, tehnička i finansijska rešenja u datim uslovima.

– Motivisanje za ulazak u sistem i prema tome povinovanje nametnutim uslovima trebalo bi da potiče iz njihove želje za obezbeđivanjem društvene, tehničke i ekonomske koristi prema agencijama za nadzor, proizvođačima, rukovaocima, inspekcijom za bezbednost. Štaviše, oni treba da budu ubeđeni da uslovi koje nameće sistem pomažu postizanju osnovnih ciljeva (t.j. zadatka).

– U cilju delotvornog funkcionisanja sistema, potrebno je da sve institucije koje donose i sprovode zakone vezane za užetni transport i bezbednost postrojenja užetnog transporta, uključujući i Državni organ za rudarstvo, Upravu za tehnički nadzor, Službu za tehnički nadzor transporta, u potpunosti odobravaju ovaj sistem.

– Sistem obezbeđuje:

- Postupke za sprovođenje standarda za poboljšavanje bezbednosti,
- Saradnju između odeljenja za istraživanje i razvoj i drugih organizacija, kao što su: Državni organ za rudarstvo, Državni nadzorni organ za rad, Uprava za tehnički nadzor, Služba za tehnički nadzor transporta, Centar za ispitivanje i licenciranje Poljske, Poljska Komisija za standardizaciju (Tehničke komisije),

- employment of available organisational and human resources for the creation and further development of the system,
- further improvements of the means and methods of safety assessment,
- creation of the database utilising effective feedback algorithms.

- Angažovanje raspoloživih i ljudskih resursa za izradu i dalji razvoj sistema,
- Dalja poboljšanja sredstava i metoda procene bezbednosti,
- Izrada baze podataka korišćenjem algoritama stvarne povratne veze.

3.2 SYSTEM MANAGEMENT - MAIN OBJECTIVES

The main objectives for the management of the mine hoist safety system are formulated as follows:

1. Management of the system should employ the theoretical and practical solutions applied in management of non-profit organisations.
2. The system is managed through the relevant strategic, tactic and operational goals:
   - strategic goals defined on the national level (state authorities and administration),
   - tactic goals defined on the national level (research and development units, universities, educational institutions dealing with rope transport safety, state agencies: UDT, TDT, WUG, PCA, PKN (KT) and others,
   - operational goals (organisations dealing with design, manufacture, operation and maintenance (i.e. mines) and testing of mine hoist components, other interested parties and individuals- experts.
3. The management system ought to be in conformity with the standard PN EN-ISO 9001:2000.
4. In the light of the incoming changes in the functioning of the state inspection agencies, the integration of New Approach Directives and a number of EU regulations to the Polish legislation must be flexible and dynamic and the process ought to be adapted to the changing external conditions.

3.2 UPRAVLJANJE SISTEMOM – GLAVNI CILJEVI

Glavni ciljevi upravljanja bezbednosnim sistemom za jamske izvozne mašine su sledeći:

1. U upravljanju sistemom trebalo bi upotrebiti teoretska i pratktična rešenja primenjena u upravljanju ne-profitnih organizacija.
2. Sistemom se upravlja kroz odgovarajuće strateške, taktičke i operativne ciljeve:
   - Strateški ciljevi određeni na nacionalnom nivou (državni organi i državna uprava),
   - Taktički ciljevi određeni na nacionalnom nivou (odeljenja za istraživanje i razvoj, univerziteti, obrazovne ustanove koje se bave bezbednošću užetnog transporta, državne agencije: UDT, TDT, WUG, PCA, PKN (KT) i drugi,
   - Operativni ciljevi (organizacije koje se bave projektovanjem, izradom, rukovanjem i održavanjem (tj. rudnici) i ispitivanjem kompenata jamskih izvoznih mašina, druge zainteresovane strane i pojedinci – eksperti.
3. Sistem upravljanja treba da bude u skladu sa standardom PN EN-ISO 9001:2000.
4. U svetlu predstojećih izmena u funkcionisanju državnih agencija za inspekciju, integracija Smernica za novi pristup i velikog broja propisa EU u zakonodavstvo Poljske mora biti fleksibilna i dinamična a proces treba da se prilagodi spoljnim uslovima koji se menjaju.

4 MANAGEMENT THROUGH GOALS

4.1 SELECTED STRATEGIC GOALS

- **The first strategic goal** of the system is coordination of law-making and standardisation approximating the Polish legislation and standards to EU requirements. **These tasks ought to be performed in such a manner that the existing safety levels in mine hoist operation in Poland must not deteriorate**.
- **The second strategic goals** is ensuring the uniformity of translation of EU directives incorporated in the Polish legal system and EU standards (translated some years ago). It is of primary importance that nomenclature be consistent, particularly in legal documents translated by different teams (such as Technical Committees within the Polish Committee for Standardisation), It is required, therefore, that cooperation between the Committees be much closer.
- **The third goal** involves taking up the necessary measures to develop the "directive on hoists' similar to the directives on cranes and cable railways (95/16/WE and 2000/9/WE) That would be the first directive initiated by Poland.

4.2 SELECTED TACTIC GOALS

In accordance with the approved objectives, tactic goals are to be defined on the level of research and development units, universities, educational institutions dealing with rope transport safety, state agencies: PIP, UDT, TDT, WUG, PCA, PKN (KT).

On the other hand, the safety of a plant whose structure is defined as elements, energy and information might be controlled at the stage of design, manufacture and operation through the use of safety excess (redundancies).

Accordingly, the basic tactic goals of the system are defined as follows:

4 UPRAVLJANJE PUTEM CILJEVA

4.1 IZABRANI STRATEŠKI CILJEVI

- **Prvi strateški cilj** sistema je koordinacija donošenja zakona i standardizacije u harmonizaciji zakonodavstva i standarda Poljske sa zahtevima EU. **Ovi zadaci treba da se izvršavaju na takav način da se ne pogorša postojeći nivo bezbednosti u radu jamskih izvoznih mašina u Poljskoj.**
- **Drugi strateški cilj** je obezbeđivanje jednoobraznosti prevoda smernica EU inkorporiranih u zakonodavni sistem Poljske i standarda EU (prevedenih pre više godina). Od izuzetnog je značaja da nomenklatura bude konzistentna, naročito u pravnim dokumentima koje su preveli različiti timovi (kao što su Tehničke komisije pri Poljskoj komisiji za standardizaciju). Stoga je neophodno da saradnja između komisija bude veoma bliska.
- **Treći cilj** obuhvata preduzimanje potrebnih mera za izradu "smernica za izvozne mašine" sličnih smernicama za kranove i jamske viseće žičare (95/16/WE i 2000/9/WE). To bi bila prva smernica čiju je izradu pokrenula Poljska.

4.2 IZABRANI TAKTIČKI CILJEVI

U skladu sa odobrenim ciljevima, taktički ciljevi se moraju definisati na nivou odeljenja za istraživanje i razvoj, univerziteta, obrazovnih ustanova koje se bave bezbednošću užetnog transporta, državnih agencija: PIP, UDT, TDT, WUG, PCA, PKN (KT).

Sa druge strane, bezbednost postrojenja čija je struktura definisana po elementima, energiji i informacijama mora se kontrolisati u fazi projektovanja, izrade i puštanja u rad kroz korišćenje viška bezbednosti (redundanci).

Shodno tome, osnovni taktički ciljevi sistema su sledeći:

- defining (establishing) the required safety levels (i.e. admissible risk levels) for personnel operating and travelling in shaft hoists,
- developing the means and methods for safety control in operation of shaft hoists,
- developing the means and methods for achieving the required safety level at minimal costs and through the use of the optimal safety excesses,
- developing the system of training for personnel responsible for the safety of hoisting operations, shaft reinforcements, conveyances, rope diagnostics (i.e. experts); for those approximating the EU laws and standards to the Polish legal system; that can be done in the form of practical training, new degree programs, post-graduate courses, training sessions, courses.

definisanje (utvrđivanje) potrebnih nivoa bezbednosti (tj. prihvatljivih nivoa rizika) za osoblje koje rukuje i prevozi se jamskim izvoznim mašinama,

- izrada sredstava i metoda za kontrolu bezbednosti u radu jamskih izvoznih mašina,
- izrada sredstava i metoda za postizanje traženog nivoa bezbednosti uz minimalne troškove i kroz upotrebu optimalnih viškova bezbednosti,
- razvijanje sistema obuke osoblja odgovornog za bezbednost izvoznih operacija, ojačavanja okna, transporta, dijagnostike užeta (tj. eksperata); za harmonizaciju EU zakona i standarda sa pravnim sistemom Poljske; to se može učiniti u obliku praktične obuke, programa novog stepena, post-dimplomskih kurseva, treninga, kurseva.

4.3 SELECTED OPERATIONAL GOALS

The operational goals stem directly from the new Geological and Mining Law, the draft of the regulation "Detailed principles of work safety" and relevant appendixes. Presently the major operational goal on the level of a mining company (an underground mine) is to put in place the **safety reporting** within the framework of the current legal system and in accordance with the relevant standards, theoretical considerations and the approved codes of practice. These are the goals for specialists in the field of mine operation who have to develop the specific inspection procedures.

4.3 IZABRANI OPERATIVNI CILJEVI

Operativni ciljevi proističu direktno iz Zakona o geologiji i rudarstvu, nacrta propisa "Detaljni opis principa bezbednosti na radu" i odgovarajućih dodataka. Trenutno najveći operativni cilj, na nivou rudarske kompanije (podzemni rudnik) jeste ustanoviti **izveštavanje o bezbednosti** u okviru sadašnjeg pravnog sistema i u skladu sa odgovarajućim standardima, teoretskim sudovima i odobrenim pravilima dobre prakse. Ovo su ciljevi za stručnjake u domenu rada rudnika koji treba da osmisle specifične procedure nadzora.

5 EDUCATION AND TRAINING SYSTEM IN THE FIELD OF ROPE TRANSPORT AT THE AGH-UST KRAKÓW

5.1 FULL -TIME AND PART-TIME DEGREE PROGRAMS

The specialist programs in ropeway transport have been available at the Faculty of Mechanical Engineering and Robotics (formerly the Faculty of Mining and Metallurgical Machines) since 1952.

This research area was first undertaken in the Department of Hoisting Installations, headed by Prof. O. Popowicz and Prof. Z. Kawecki and later

5 SISTEM OBRAZOVANJA I OBUKE U DOMENU UŽETNOG TRANSPORTA NA AGH-UST U KRAKOVU

5.1 PROGRAMI SA PUNIM I DELIMIČNIM RASPOREDOM

Specijalistički programi u domenu užetnog transporta su na dostupni na Fakultetu za mašinstvo i robotiku (prethodno Fakultet za mašine u oblasti rudarstva i metalurgije) od 1952. godine.

Ova oblast istraživanja je najpre započeta na Odseku za izvozna postrojenja, na čijem čelu su bili prof. O. Popowicz i prof. Z. Kawecki,

(1973-1992) the work was continued in the Environmental Laboratory of Rope Testing and Transport Equipment and then in the Department of Rope Transport. The Environmental Laboratory was establisned by Prof. Juliusz Stachurski, who remained in charge till 1981 and was then succeeded by the Author prof. Józef Hansel of this publication.

The Department of Ropeway Transport is in the structure of the Faculty of Mechanical Engineering and Robotics which currently employs 215 academic staff members, including 11 full professors, 25 assistant professors, 126 academic holding a post-doc position (3 of them completed the Great Doctorate).

In 2003 the Faculty of Mechanical engineering and Robotics has passed the certification procedure and is now accredited by the Technical Education Accreditation Board as an institution granting the degrees in the specialisations:

- mechanics and machine design,
- automatics and robotics.

In June 2005 the State Accreditation Committee revisited the Faculty premises to evaluate the quality of BSc and MSc degree programs in mechanics and machine design. The results of this evaluation were positive. The final results of the accreditation procedure will be published shortly.

MSc and post-graduate curricula at the Faculty of Mechanical Engineering and Robotics include the issue having relevance to the EU integration. Several lectures are available:

- Legal aspects in engineering,
- Safety of technical systems,
- Rope installations safety,
- Standardisation and quality control,
- Creativity in engineering, protection of industrial property.

The Department is responsible for the specialisation "Rope Transport" available at the Faculty of Mechanical Engineering and Robotics within the part-time and full-time BSc and MSc degree program "Mechanics and Machine Design".

a kasnije (1973-1992) rad je nastavljen u Ekološkoj laboratoriji za ispitivanje užadi i transportnu opremu. Ekološku laboratoriju je osnovao prof. Prof. Juliusz Stachurski, koji je ostao na poziciji rukovodioca do 1981. godine kada ga je zamenio autor ovog rada prof. Józef Hansel.

Odsek za užetni transport u sklopu je Fakulteta za mašinstvo i robotiku koji trenutno zapošljava 215 akademika, uključujući 11 redovnih profesora, 25 asistenata, 126 akademika koji imaju post-doktorsku poziciju (3 od njih su stekli Veliki doktorat).

Godine 2003. Fakultet za mašinstvo i robotiku je uspešno prošao postupak sertifikacije i sada je akreditovan od strane Odbora za akreditaciju u tehničkom obrazovanju kao ustanova koja dodeljuje diplome za sledeće specijalizacije:

- Mašinstvo i projektovanje mašina,
- Automatika i robotika.

U junu 2005. Državna komisija za akreditaciju je ponovo posetila prostorije Fakulteta radi procene kvaliteta programa osnovnih i magistarskih studija u oblasti mašinstva i projektovanja mašina. Rezultati ove procene su bili pozitivni. Konačni rezultati procedure akreditacije biće uskoro objavljeni.

Nastavni planovi za magistarske i post-diplomske studije na Fakultetu za mašinstvo i robotiku uključuju predmet koji se odnosi na evropske integracije. Na raspolaganju su nekoliko predavanja:

- Pravni aspekti u inžinjeringu
- Bezbednost tehničkih sistema,
- Bezbednost užetnih postrojenja,
- Standardizacija i kontrola kvaliteta,
- Kreativnost u inžinjeringu, zaštita industrijske imovine.

Odsek je odgovoran za to da specijalizacija „Užetni transport" bude omogućena na Fakultetu za mašinstvo i robotiku u okviru programa osnovnih i magistarskih studija sa punim i delimičnim rasporedom pod nazivom „Mašinstvo i projektovanje mašina."

5.2 POST-GRADUATE COURSES

Since 1976 AGH-UST has oferred the following post-graduate courses:

1. Maintenance of wire ropes.
2. Operation and maintenance of machines in rope installations (1979-1992).
3. Rope transport (since 1992).

The author of this publication prof. Józef Hansel organised and course "Operation and maintenance of machines in rope installations" in 1979. In 1992 the course name was changed to "Rope transport".

The post-graduate courses "Rope transport" are intended for designers, manufacturers and operators of rope installations and components: cable railways, ski-lifts, mine hoists, open-cast mining machines, passenger lifts, man-material lifts, cranes, lifting devices, cable structures: radio and TV masts, wire ropes, rubber-coated wire ropes, and for the personnel of certification laboratories and control agencies responsible for inspection of these machines and installations. The syllabus covers the issues relating to the approximation of the Polish economy to the EU requirements and theory and practice of development of safe operation systems.

The post-graduate course "Ropeway transport' covers:

1. Rope installations – design, operation and maintenance of ropeway installations in the mining sector
2. Ropeway installations – cable railways and ski-lifts
3. Rope installations – passenger lifts, man-material lifts and cranes

So far 850 students have completed the post-graduate courses: personnel of the technical inspection office, academics from research and development units, design offices. In the academic year 2008/2009 there are 32 participants.

The Department provides the training programs for foreign users of the magnetic testing equipment manufactured in Poland. Nearly 100 specialists from Great Britain, France, Germany, Romania, India, Zambia, USA have already attended these courses. The person in charge is dr. Lesław lankosz.

5.2 POST-DIPLOMSKI KURSEVI

Od 1976. Univerzitet AGH-UST nudi sledeće post-diplomske kurseve:

1. Održavanje žičane užadi.
2. Rad i održavanje mašina u užetnim postrojenjima (1979-1992).
3. Užetni transport (od 1992).

Autor ovog rada, prof. Józef Hansel organizovao je i nastavu „Rad i održavanje mašina u užetnim postrojenjima" godine 1979. Godine 1992. ime kursa promenjeno je u „Užetni transport".

Post-diplomski kursevi „Užetni transport" namenjeni su projektantima, proizvođačima i osoblju koje radi na užetnim postrojenjima i komponentama: jamskim visećim žičarama, ski-liftovima, jamskim izvoznim mašinama, mašinama za površinsko otkopavanje, dizalicama za putnike, dizalicama za osoblje i materijal, kranovima, uređajima za podizanje; visećiim konstrukcijama: radio i TV antenama, žičanoj užadi, žičanoj užadi obloženoj gumom, i za osoblje laboratorija za sertifikaciju i kontrolne agencije odgovorne za kontrolu ovih mašina i postrojenja. Predavanja obuhvataju pitanja vezana za harmonizaciju poljske privrede sa evropskim zahtevima i teoriju i praksu razvoja sistema za bezbedan rad.

Post-diplomski kurs „Užetni transport" obuhvata:

1. Užetna postrojenja – projektovanje, rad i održavanje užetnih postrojenja u rudarskom sektoru
2. Užetna postrojenja – jamske viseće žičare i ski-liftovi
3. Užetna postrojenja – dizalice za putnike, dizalice za osoblje i materijal i kranovi

Do sada je 850 studentata završilo post-diplomske kurseve: zaposleni u službi za tehnički nadzor, akademici iz odeljenja za istraživanje i razvoj, projektnih biroa. U akademskoj godini 2008/2008 ima 32 učesnika.

Odsek pruža programe obuke za inostrane korisnike opreme za magnetno testiranje proizvedene u Poljskoj. Skoro 100 specijalista iz Velike Britanije, Francuske, Nemačke, Rumunije, Indije, Zambije, S.A.D. je već pohađalo ove kurseve. Odgovorno lice je dr. Lesław Lankosz.

In the EU there is a system of certification of personnel responsible for non-destructive testing in accordance with the standards EN 473 and EN 45013. Their competences must be verified and confirmed by the authorised certification agencies.

A system of qualification of non-destructive testing personnel UDT-CERT has been in place for several years in Poland. The system is supervised by the Technical Inspection Office in Warsaw.

Following the decision of the Technical Inspection Office two centres were established on 5th Nov 2003 at the AGH-UST, which meet the requirements set forth in the standard PN-EN 473:

- Training centre – providing the specialist training for personnel responsible for non-destructive magnetic testing (magnetic inspection of wire ropes),
- Examination centre (magnetic testing of ropes).

The director of these two centres is dr hab. Jerzy Kwaśniewski, professor of AGH-UST.

U Evropskoj Uniji postoji sistem sertifikacije osoblja odgovornog za ne-destruktivno ispitivanje u skladu sa standardima EN 473 i EN 45013. Njihovu stručnost moraju proveriti i potvrditi ovlašćene agencije za sertifikaciju.

Već nekoliko godina u Poljskoj postoji sistem za kvalifikaciju osoblja za ne-destruktivno ispitivanje UDT-CERT. Ovaj sistem nadgleda Uprava za tehnički nadzor u Varšavi.

Po osnovu rešenja Uprave za tehnički nadzor, 5. novembra 2003. osnovana su dva centra na AGH_UST, koji ispunjavaju uslove predviđene standardom PN-EN 473:

- Centar za obuku – koji pruža specijalističku obuku za osoblje odgovorno za ne-destruktivno magnetno ispitivanje (magnetni pregled žičane užadi),
- Centar za ispitivanje (magnetno testiranje užadi).

Direktor ova dva centra je dr Jerzy Kwaśniewski, profesor AGH-UST.

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