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Approved For Release 2009/04/27 : CIA-RDP80T00246A008000120002-8

Table of Contents

25X1

	<u>Page</u>
Part III	
5. Mechanization of Concrete Work	1
6. Mechanization of Finishing Work	2
7. Indexes of Mechanization of Selected Processes	3
Part IV	
Utilization of Equipment	10
Index of Use of Equipment	11
Part V	
Summary	12

This is UNEVALUATED Information

25 YEAR RE-REVIEW

5. Mechanization of Concrete Work.

The following processes~~s~~ can be separated when handling and using concrete:

Mixing of concrete called also preparation of the concrete mixture

Transportation of concrete from the concrete mixer to the place where it is used

Compacting of concrete

Curing of concrete

Mixing of concrete.

This operation is 90% mechanized in Poland, i.e. to its highest practical level. There is no manual mixing of concrete on the building sites except on very small projects in villages or on individual houses. There were about 9,000 concrete mixers in Poland in 1957, which was regarded as a sufficient number. However, more small concrete mixers are needed in order to mechanize small construction projects. Such small concrete mixers of about 75 and 100 liters capacity will be manufactured in the years 1959-65.

Transportation of concrete to floors of the buildings under construction is done vertically by lifts and horizontally by wheel barrows. If a tower crane is used on the building site, the concrete mixer is located within the reach of its arm and in such a case it can be said that the transportation of concrete is fully mechanized. Often the concrete is mixed in a plant. This can be on the construction site, i.e. on a large construction project site there is a separate area where several stationary concrete mixers are set. Such a shop on the construction site serves all buildings during their construction. It is also called a "field concrete plant". In addition to a "battery" of concrete mixers it also has storage for aggregates, transportation

installations, and a small field laboratory.

There are also permanent central concrete depots which are permanent investments serving several construction projects or even a workers' settlement under construction. The concrete is delivered to the site by trucks and the distance should not exceed a half-hour drive by truck. This delivery should be done in special trucks or by rotating concrete mixers. However, there were only about 100 such special mixers in 1957 and in most cases the concrete is transported by ordinary trucks with open metal vats, in old small-gauge railway wagons, etc.

It is estimated that the output of concrete made in the field and permanent central concrete shops amounted in 1957 to 15% of the total concrete used and in 1959 will rise to about 20%. The transportation of this concrete is mechanized but in the way described above. The mixing is fully mechanized by using half automatic dosimeters and with field laboratories which prepare prescriptions and make tests and checks. Large permanent central concrete shops also have defrosting plants for gravel, and installations for warming water, sand, etc.

Compacting of concrete is mostly manual in Poland. Mechanization of this process includes vibration with the aid of various types of vibrators such as surface, deep, attached to casings, or frames, etc. Poland manufactures about 500 deep vibrators of poor quality per year. In Poland, in 1957, vibrations were used in 40% of this work and in 1959,  about 45%. This also includes 25X1 vibration of prefabricated concrete elements, so vibration of monolithic concrete on the building sites probably amounts to only 25%.

Curing of concrete during binding and setting. There are two known methods of steam curing to accelerate binding, and by electric radiators during forsts, but they are applied only on a few sites affecting about 5% of the total mass of concrete used. In addition, the prefabricated concrete elements undergo a treatment of artifical ripening.

The transportation of concrete from concrete mixer to the point of pouring can also be mechanized by the use of pumps. There were 20 such pumps in Poland in 1957, and their number has probably not increased. This method means full mechanization of mixing and transportation of concrete but its share in total mass concrete work is no higher than 3-4%.

Prefabrication of concrete elements.

This subject belongs to another problem - to the "industrialized construction." It is mentioned here because prefabricated concrete elements represent full complex mechanization of all processes of laying of concrete. Mixing in the plant is mechanized, compacting is done with the use of vibrators, vibrating tables and vibrating presses, curing is mostly by artifical ripening heat and steam treatment, transportation to the building site is by trucks, and assembling of elements is done by tower cranes.

Therefore in order to define the degree of mechanization of concrete work in Poland one must examine the scope of prefabrication of concrete elements in Poland. According to an article written by B. Kierski and J. Witkowski which was published in Inwestycje i Budownictwo, in February 1959, "Technical problems in construction 1959": ..... It is expected that these two methods (assembling of buildings of large-block and large-panel elements) will be applied on about two million cubic meters of

housing projects constructed by the enterprises subordinated to the Ministry of Construction. Besides the above, about 1.8 million cubic meters of housing will be built with the so-called first degree of industrialization (1959)." In addition to these 3.8 million cubic meters of housing ~~buildings~~ constructed with the use of prefabricated elements, there will be also 5.4 million cubic meters <sup>of prefabricated concrete buildings</sup> built from prefabricated elements in 1959, ~~in industrial construction~~. A big increase of prefabricated concrete elements is planned for the period 1961-65. The chairman of the Economic Planning Commission, Jedrychowski, gave the following figures in his speech according to Trybuna Ludu 13 March 1959; ..... "It is assumed that at least over 30.5% of the total number of housing constructions in towns in 1965 should be constructed by industrialized methods...." The use of prefabricated concrete, reinforced concrete and prestressed string concrete elements in industrial construction will amount to:

8.5	million	cubic	meters	in	1958
10.0	"	"	"	"	1960
24.5	"	"	"	"	1965

Detailed figures are also given in an article by B. Kierski "Technical progress in construction during the Five Year Plan 1961-65," published in Przegląd Budowlany, April 1959. On this basis the Source prepared the table on the next page. On the basis of these figures it is possible to estimate the quantity of prefabricated concrete and reinforced concrete elements in relation to the total of concrete work. It amounted in 1957 to about 12%, while the remaining 88% was cast in place. It should be remembered that prefabricated elements for ceilings were used not only in industrial but also in general construction. Already in 1957, about 60%

Housing Construction								
	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>
Housing Construction								
1. Total numbers of rooms in towns and settlements:thousands			314	335	366	399	435	465
2. Number of rooms constructed by industrialized methods: thousands			36	53	79	106	128	146
3. Of this: constructed by the Ministry of Construction by industrialized methods	13	22	35	51.5	75	100	120	136
4. percentage 2:1	6.5**	8.1	11.4	15.8	21.6	26.6	29.4	31.4
5. percentage of industrialized construction of the ministry of Construction, to the total number of rooms built by the Ministry of Construction			21	28	37	45	49	52
6. Enclosed space of industrial projects having Concrete Superstructure prefabricated (in million cu.meters)	8.5*	9.2**	10	11.8	13.2	16.0	20.	24

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\* Source Je drychowski Speech 12. III 1956?

\*\* Own Estimate

Note: In 1965 the Ministry of Construction is planning to build 70% of industrial construction as prefabricated construction

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Sources: Article by B. Kierski: "The Case of Productivity in Housing Construction" (M Zubelewicz published in Gospodarka Planowa No. 5, 1959 p.1-6

of housing ceilings were made from prefabricated reinforced concrete beams. In 1959 about 15% of the total mass of concrete will be manufactured by the prefabricated method. It is planned that in 1965 about 30% of concrete used will be prefabricated. The prefabricated elements are manufactured and for this reason they are included in the category of complex mechanized production. It is difficult to give a short definition of the degree of mechanization of concrete work and for this reason the Source gives the following resumé:

a/ The complex mechanization of concrete work exists in prefabricated concrete elements, which amounted to 15% of the total concrete work in Poland in 1959.

b/ In the remaining monolithic concrete work complex or almost entirely complex mechanization of work was realized by the introduction of concrete plants in connection with the use of tower cranes, or pumps and vibrators. ~~On~~ this way a further complex mechanization of 10% was realized in 1959. Thus about 25% of concrete work was at the level of complex mechanization.

c/ In the remaining 75% of concrete work there is only partial mechanization. Mixing is mechanized 90%, and compacting only 40%.

d/ A further increase of mechanization is foreseen, a doubling of the present percentage up to 1965 and complex mechanization of concrete work described in para a/ and b/ will reach in 1965 about 40% of the total mass of concrete in Poland.



6. Mechanization of finishing work.

The mechanization effort in Poland was directed first of all on heavy, unskilled labor-~~suming~~<sup>consuming</sup> work, such as earthwork, transportation on the building site and mixing of concrete. The mechanization of finishing work was neglected, and is more difficult to introduce. In this second stage of mechanization, the work of a skilled worker is aided by mechanized equipment driven by compressed air or electricity, such as electric saws, pneumatic hammers, drills, wall chisels, spray guns, grinders, planers and shapers.

The mechanization of finishing work is also called the mechanization of skilled artisan work and is neglected in Poland. It is more expensive than the mechanization of heavy labor-consuming work, requiring small tools, manufactured from hard steel. At the present, 15 years after World War II, Poland has begun to consider this mechanization and plans to introduce about 60,000 mechanized tools during the period 1961-1965. According to an article written by B. Kierski, "Progress In Construction In The Five Year Plan 1961-1965," Przegląd Budowlany, April 1959, p. 161-165, as follows:

24,000	electric carpentry, locksmith and masonry tools
5,000	machines for finishing floors
5,000	apparatus for drilling installation hooks, for piercing openings and cavities
14,000	painting tools
8,000	equipment for plastering

this plan is not realistic and that it will be 25X1

implemented to only 50% for various reasons: shortage of steel, pipes, hoses, transformers, reluctance of the machine industry to produce small precision products

due to the difficulty of designs, lack of experience in this type of production, and the necessity of spare parts production. In addition, the skilled artisans are reluctant to adopt these new techniques. The mechanized work at the enterprises subordinated to the Ministry of Construction includes painting 20%, finishing floors 10% and grinding terrazzo 15%.

Considerable time is lost in finishing operations caused by cutting openings for water pipes and power lines due to poor planning and workmanship. This work is done manually with chisel, plane and hammer and is one of the most backward operations in Polish construction.

#### Plastering

According to the official statistics plastering is highly mechanized. According to an article written by Kierski and Zubelewicz, "Efficiency of Work in Housing Construction," Investycje i Budownictwo, no. 51, 1959. ...." Mechanization of plastering work at the Ministry of Construction was:

in 1952	8.6%
1953	15.0%
1954	32.0%
1955	55.0% .....

These figures are entirely false. In 1957, no more than 8-10% of total plastering and about 15% of the plastering done by enterprises of the Ministry of Construction was mechanized. The false figures are the result of the following: Construction enterprises were pressed by the government to introduce mechanization of plastering and premium awards were begun. The enterprises installed some equipment for the mechanization of plastering, such as, mixers, pumps, injection nozzles, spray guns and smoothers. All this equipment was generally idle on the construction site and

very seldom used. The equipment was of poor quality and required high maintenance costs, as a result it is very well known that most of plastering is done manually. But the enterprises reported that they were plastering mechanically even when only the mortar was mixed mechanically. There are various types of mixers and even a concrete mixer can be used for mixing mortar. The high figures of mechanization of plastering originated in **this** way. In 1956-1957 it was announced that even the outside plastering was to be mechanized. However, this was done only in Warsaw on three building sites where two master masons plastered the fronts of buildings using mechanical sprayers.  in reality in 1959, no more than 25X1 10% of all plastering is done mechanically and in the enterprises subordinated to the Ministry of Construction about 20%. All higher figures given from time to time are untrue.

#### Remarks

This mechanization of finishing work or, mechanization of skilled work, mechanization of artisan work, or also-called mechanized equipment, should not be mistaken for the often used definition "small mechanization" (*Mala mechanizacja*). Small mechanization refers to heavy, labor-consuming processes such as transportation, assembly of heavy units, earthwork, etc. The word "small" means that the enterprises<sup>t</sup> itself, or the construction management is using its own combination of simple equipment, e.g., electric lift which pulls heavy stone or concrete blocks from ditches, any kind of hoisting equipment, winches, ropes, A-frames, etc., for lifting of heavy elements when cranes are not available. This is the mechanization of difficult work using primitive means and small investments applied locally.

The government has been working since 1950 to impress upon the construction enterprises that they must try to solve the problems themselves and not wait for modern equipment to be supplied by the state. The construction managers demand modern machinery, and if they don't receive it they work manually. The government is of the opinion that the engineers should organize among themselves a pool of old machinery and introduce small scale mechanization whenever possible. The government allocated some funds for the small mechanization, described above, but it did not achieve any larger results. For this reason many articles appear in the daily press and in engineering publications about "small mechanization", but in practice although some engineers were able to improvise clever and inexpensive inventions for the improvement of work, this activity did not spread and its importance and effects for the Polish construction industry is limited.

7. Indexes of mechanization of important construction processes.

[redacted] indexes of 20 operations connected with earth work, transportation 25X1 on the building site, concrete work, loading and use of containers, and finishing work. The indexes of mechanization for these processes are given in the Polish official statistics without the explanation that these indexes refer in fact only to one basic process of any operation and not to the whole work.

The following tables contain indexes for each process separately and in addition indexes of complex mechanization for the whole work [redacted] after 25X1 thorough analysis based on his own experience.

The tables give average national indexes and also indexes of the Ministry of Construction. The last are higher because the enterprises subordinated to the Ministry of Construction, are on a higher level of mechanization of construction work and have better equipment than the rest of the construction industry.

[redacted] calculations and estimates which differ from some official statistics 25X1 or indexes [redacted] which are not given in the official statistics, are marked "s" Approved For Release 2009/04/27 : CIA-RDP80T00246A008000120002-8

## INDEXES OF MECHANIZATION OF CONSTRUCTION WORK

		Average Index of	
		The Country	Enterprises of
		(National)	The Ministry
			of Construction
EXCAVATION & EARTHMOVING			
	<u>%</u>		<u>%</u>
1. Basic Operation: Digging		1950	32.5
		1952	63.0
	1957 59 <sup>s</sup>	1957	78.0
		1958	81.0
	1959 66 <sup>s</sup>	1959	83.0 <sup>s</sup> plan
	1965 85 plan	1965	90.0 <sup>s</sup> "
-----			
2. Dozing	1959 25 <sup>s</sup> -27 <sup>s</sup>	1959	40 <sup>s</sup>
-----			
3. Short distance transport & dumping	1959 1 <sup>s</sup>	1959	4 <sup>s</sup>
-----			
4. Scraping	1959 1 <sup>s</sup>	1959	4 <sup>s</sup>
-----			
5. Grading	1959 6 <sup>s</sup>	1959	10 <sup>s</sup>
-----			
6. Long distance earth moving			
a. By dumpers	1959 20 <sup>s</sup>	1959	40 <sup>s</sup>
b. By trucks or other motorized vehicles	1959 60 <sup>s</sup>	1959	40 <sup>s</sup>
-----			
7. Complex Mechanization	1959 18 -20 <sup>s</sup>	1959	25 <sup>s</sup>
-----			
TRANSPORTATION ON THE CONSTRUCTION SITE			
	<u>%</u>		<u>%</u>
8. Lifting Operations, Basic Operation with the aid of lifts		1950	60
		1951	70
		1952	94
		1953	96
		1954	98
	1955 90	1955	98.5
	1959 95	1959	98.5
-----			
9. Lifting Operations and vertical-horizontal transport with the aid of tower cranes		1953	1.0
		1954	1.0
		1955	13.1
		1958	37.0
	1959 15-20 <sup>s</sup>	1959	45.0 plan
	1965 30	1965	65.0 <sup>s</sup> plan
-----			
10. Complex Mechanization with the aid of tower cranes and self-propelled fork lift cranes	1959 1	1959	3.0
		1965	15.0 <sup>s</sup> plan

		Average Index of			
		The Country (National)		Enterprises of The Ministry of Construction	
		<u>%</u>		<u>%</u>	
LOADING OPERATIONS AND USE OF CONTAINERS					
11. Mechanization of Loading of loose Materials and granular materials	1958	12	1958	17	
	1959	13	1959	20	
	1965	25 <sup>s</sup>	1965	50 <sup>s</sup>	plan
12. Transport of loose cement	<del>1958</del>	30	1959	1	
			1965	40 <sup>s</sup>	plan
13. Transport of Bricks in Containers	1959	1	1959	3 <sup>s</sup>	
-----					
CONCRETE WORK					
14. Basic Process Mixing of Bulk Concrete	1959	90	1959	94 <sup>s</sup>	
15. Complex Mechanization					
a. By prefabrication and assembling of the unit elements on the construction site	1959	15 <sup>s</sup>	1959	20 <sup>s</sup>	
	1965	30 <sup>s</sup>	1965	40 <sup>s</sup>	plan
b. With the aid of semi-automatic permanent and movable shops equipped with mixers, vibrators, etc.	1959	10 <sup>s</sup>	1959	20 <sup>s</sup>	
	1965	20 <sup>s</sup>	1965	25 <sup>s</sup>	plan
c. Total Complex Mechanization	1959	25 <sup>s</sup>	1959	40 <sup>s</sup>	
16. a. Simple mechanization, vibrated concrete	1965	50 <sup>s</sup>	1965	65 <sup>s</sup>	plan
	1959	10 <sup>s</sup>	1959	20 <sup>s</sup>	
	1965	20 <sup>s</sup>	1965	25 <sup>s</sup>	plan
b. Total concrete work, which is vibrator compacted	1959	40 <sup>s</sup>	1959	60 <sup>s</sup>	
	1965	70 <sup>s</sup>	1965	90 <sup>s</sup>	plan
-----					
(Total of 15 c plus 16 a)					
FINISHING OPERATIONS AND MECHANIZATION OF ARTISAN WORK					
17. Plastering Work	1959	8-10 <sup>s</sup>	1959	20 <sup>s</sup>	
The figures given in official statistics for the Ministry of Construction indexes					
	1952	8.6%			
	1953	15.0			
	1954	32.0			
	1955	55.0			
are misleading					
18. Painting	1959	15 <sup>s</sup>	1959	20 <sup>s</sup>	
19. Oak Board Floor Finishing	1959	10 <sup>s</sup>	1959	15 <sup>s</sup>	
20. Terrazzo Floor Finishing	1959	8 <sup>s</sup>	1959	15 <sup>s</sup>	

#### IV. Utilization of equipment

The most distressing aspect of mechanization in the construction industry in Poland is the poor utilization of equipment.

Every time the Ministry of Construction asks for more equipment, the State Economic Planning Commission answers that the allocated equipment could perform much more work than it does; that there is excessive idle time for the machines. An extensive reporting system on the utilization of equipment was introduced; norms for equipment work were fixed; controls and inspections were conducted without resulting in any improvement. The following quotation from an article by B. Kierski, "Technical Progress in Construction in the Five Year Plan 1961-1965", published in Przegląd Budowlany, April 1959 confirms the situation:

....." the recent years have not so far displayed any basic improvement in the degree of utilization of the construction machines already possessed in the country... It is necessary to attain at least a 20 percent increase in the utilization of machines....." In the reports on utilization submitted to the Main Statistical Administration (GUS) several indexes are used: In order to show what they mean the following example is taken from the article by B. Kierski, "Technical Progress in Construction", published in Inwestycje i Budownictwo, No 8, 1958.

Utilization of single-bucket excavators in socialized enterprises  
included in the central plan in 1956

Number of excavators	553	
Nominal number of machine days (norm)per excavator	300	
Actual number of machine days given per excavator	286	
Total machine days	158,347	
of which, in repair or awaiting repair	52,491	33.1%
Total machine hours available for work (i.e. excluding repair time)	1,328,958	
Number of hours actually worked	775,792	58.4%
Number of hours idle	553,164	41.6%



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Generalizing from this example  the 25X1

index of idleness of heavy machinery is constructed as follows:

The norm for working days per machine is 300 per year. In actual practice this usually amounts to 280-290 because machines are being brought into use and scrapped throughout the year.

About  $1/3$  of this time is assigned to medium and major repairs, and the time spent waiting for these repairs.

Of the remaining time, 200 days per year, about 60% is actually spent working, the other 40% is idle time or the index of idleness.

The usual GUS terminology is as follows:

<u>Nominal days</u>	norm of working days per machine
<u>Repair days</u>	major repairs and time spent waiting for them.
<u>Exploitation time</u>	nominal time minus repair time
<u>Index of idleness</u>	the % of exploitation time the machines are idle.

This includes transportation time, work stoppages, etc.

Any preventive maintenance and minor repair time is included in exploitation time. Only major overhauls and repairs are included in the 33% of total or nominal time assigned to repairs. Such work is planned for the winter months when the machines can't work on site anyway. A major breakdown at other times becomes a minor catastrophe.

The number of available machine hours depends, naturally, on the number of shifts per day. On average, 1.5 to 2 shifts are planned per 24 hours for heavy construction machines.

In the ~~example~~ cited, there were a total of 1,328,956 machine hours available for work (exploitation time). Usually, the enterprises plan on 2 shifts in the long day-light summer months and 1 to 1.5 in spring and autumn. In the example given, the average working day is 12.55 hours, i.e., total exploitable hours divided by total nominal machine days minus repair days. So each machine actually worked an average of 7.5 hours per exploitation day.

This high degree of idleness shows how poor the utilization of equipment is. It is mainly due to the poor planning and indolence of the construction managers, neglect of preparatory work, carelessness of ~~generators~~ <sup>operators</sup> resulting in breakdowns of equipment, a very severe shortage of spare parts and sometimes a shortage of gasoline.

Preventive maintenance and repair are not done well or quickly due to the lack of skilled mechanics, the fact that little can be done before or after normal working hours because stealing of spare parts is so widespread, and because often the only way to replace a broken part is to steal it from another enterprise or cannibalize one's own equipment.

It should be remembered that reports are falsified and the amount of idleness is actually greater than reported. There is a limit to this falsification however, because the number of working machine hours must agree to some extent with the wage list of machine operators.

According to the same Source (B. Kierski in Inwestycje i Budownictwo, No 8 1958) the index of idle time for other machines belonging to socialized enterprises in the central plan (this means 98% of the socialized construction industry) was as follows:

	Index of idle time* %	
	1956	1957**
Excavators, Single Bucket	41.6	34.5
" Multi-Bucket	57.8	59.5
Bulldozers	24.2	21.9
Earthmovers	52.6	58.9
Crushing Machines	63.5	
Concrete Mixers	43.5	
Tower Cranes	22.7	18.8
Selfpropelled cranes	20.7	23.0

The index of idle time refers to idle hours on the construction site. A machine could and should work according to a plan, but because of some mistake by management, or for other reasons, it is idle. These idle hours represent a complete loss. The time for repairs is also a nonproductive period, but when we deduct from nominal machine days machine days in repair, we get so-called exploitation days, and the percentage of the exploitation days to the nominal working machine days is is called index of exploitation or employment.

As mentioned above, about one third of the nominal working machine days is used for repairs, therefore the index of exploitation amounts to about 66%. Of this 66%, the machines stay idle in our example about 42%, which means that they work productively only 58% of their exploitation time i.e.  $\frac{58\% \times 66}{100}$  i.e. 38% of their nominal time. This 38% is the index of productive work.

\* Percent of exploitable time which is not worked for one reason or another.

\*\* The figures for the year 1957, given according to the article written by A. Junak under the title "Figures.... figures"..... in Fundamenty 26 July 1959,

The percent of real work in relation to the nominal days of possible work is shown in Table 3. It shows index of exploitation (employment) for 1958 in column 2, actual percentage of working and idle time in column 3 and 4, and percentage of real employment time in column 5.

This table is based on an article written by B. Kierski "Technical Problems in Construction 1959", published in Inwestycje i Budownictwo, February 1959, page 17-24.

Table 3

Type of Machine	% of 1958 Employment Time on Construction Sites	of which:		Index of Employment, 1958, of machines, % of Nominal (possible) employment time actually worked
		Actual Working Time %	Idle Time %	
Excavators				
Single-bucket	66	58	42	38
Multi-bucket	33	32	68	10
Bulldozers	65	71	29	46
Shovelling Machines	74	72	27	54
Tower Cranes	26	43	57	11
Self-propelled cranes	53	75	25	40

Thus, the real productive work of equipment is only a small fraction of what could be done with the aid of these machines. It shows how badly the equipment is utilized and this is illustrated by the following quotation...." A measure of the organizational shortcomings of mechanization of work are the idle periods of equipment which amount to 25 to 57 percent of the time of employment of machinery on the construction site. The average repair index of 30 percent may still be seriously cut, particularly where medium and current repairs are concerned. The employment of machines in actual work with relation to the total time of utilization (nominal working machine days) of equipment oscillates from only 10 percent to at most, 54 percent...."

Source: Bolewslaw Kierski & Jerzy Witkowski "Technical Problems in Construction 1959", Inwestycje i Budownictwo, February 1959, Warsaw, page 17 -24

In connection with this bad utilization of construction equipment in Poland

it is striking that the yearly output norms are often implemented satisfactorily,

at least by some equipment such as single bucket excavators, earthmovers, and self-

propelled cranes. The following table shows that in 1957:

Single bucket excavators implemented 97% of their yearly norms

Bulldozers	"	140%	"	"	"	"
------------	---	------	---	---	---	---

Selfpropelled cranes	"	115%	"	"	"	"
----------------------	---	------	---	---	---	---

But the following equipment did not implement its norms:

Multi-bucket excavators	"	"	"	60%	of their yearly norms		
-------------------------	---	---	---	-----	-----------------------	--	--

Tower cranes	"	"	"	48%	"	"	"	"
--------------	---	---	---	-----	---	---	---	---

Earth movers	"	"	"	69%	"	"	"	"
--------------	---	---	---	-----	---	---	---	---

During the first half of 1958, whose norm because of winter amounted to 45%

of the yearly norm, the following record of non-implementation (90% of norm) was

made:

Single bucket excavators and bulldozers	4%
---	----

Multi-bucket "	24%
----------------	-----

Tower cranes	11%
--------------	-----

Earthmovers	39%
-------------	-----

Selfpropelled cranes	28%
----------------------	-----

The question arises as to how equipment which is utilized productively only

10 to 57% of its nominal working time, can implement or even exceed the norms.

Utilization of Construction Equipment in Poland

Type of Machine	Annual Output Norm per Unit	Percentage of Execution of Annual Norm		Percentage of Execution of Half-Year Norm (45% of yearly Norm) 1958	Repair Time in % 1958	Index of Non-Execution due to repair time and idle time 1958
		1956	1957			
Single bucket excavators	74,000 m <sup>3</sup> * per M <sup>3</sup> bucket	103	94	86	30	4
Multi-bucket excavators	600 m <sup>3</sup> per m <sup>3</sup> h	57	60	22	43	24
Power Shovels	6,400 m <sup>3</sup> per m <sup>3</sup>	96	69	42	34	39
Bull dozers	700 m <sup>3</sup> h.p.	126	140	115	31	4
Tower Cranes	2,500 tons per ton	72	48	63	14	11
Self-Propelled cranes	2,500 tons per ton	98	115	99	19	28

\* The norm reported is the average between the norms of 85,000m<sup>3</sup> for front loaders and 55,000m<sup>3</sup> for clamshell types

Source: Kierski and Witkowski, "Technical Problems in Construction 1959" Inwestycje i Budownictwo Feb 59, pp.17-24  
(Translated by JMB : 1014-0 31 July 59. U.)

Norms are sometimes fulfilled in such conditions for the following reasons:

- a. The norms are too low. They are much lower than in the West. In Poland an excavator with one cubic meter bucket capacity has a yearly norm of 85,000 cubic meters, while in the West it averages 120,000 cubic meters.
- b. The output is falsified in the periodic reports. The quantity of earthwork is very difficult to check and easily falsified. The so-called "long pencil system" described earlier high wages paid to machine operators, etc. allow favorable conditions for falsifying.
- c. The equipment is badly managed. Machines are very often idle for long periods and then they are used for two or three shifts, disregarding instructions, periodic inspections and maintenance repairs. As a result the machines are damaged and worn out. For this reason the life of equipment is short, and it needs major repairs sooner.

The tendency to exceed the norms not by regular work but by short excessive spurts is unwise. Idleness of equipment is a waste of time and money, but so is over working it, especially bulldozers and self-propelled cranes, and great losses also result.

#### Part V. Summary

The principle of development of mechanization in Poland is no doubt quite rational. The shortage of labor will undoubtedly increase in connection with the industrialization of the entire country and with the large demands for labor for agriculture. However, the methods chosen for the realization of this principle were not the best, and have proven ineffective. Although mechanization has increased 11 times in comparison with the prewar standard and is still increasing, there is no equivalent increase of productivity in the construction industry.



According to calculations made by Artur Wislicki, an employee of the Institute for Organization and Mechanization of Construction, and published during the National Convention of Construction in 1956, the existing amount of equipment can replace 350,000 workers. Although this estimate is too high for 1956, it is probably true at present, in 1959, after the additional increase of equipment in the years 1956-1959. However, because of fragmentary and incomplete mechanization of work processes, these advantages of current mechanization are greatly reduced.

The mechanization of the construction industry which has so much heavy and labor-consuming work, huge transportation tasks, pays for itself quickly as in every backward industry. Taking into account all the social costs of a live worker, despite low wages, mechanization in the construction industry should always be cheaper than manual labor. But improper utilization of equipment and bad administration cause the loss of a great part of the advantages of mechanization.

The causes of bad utilization of equipment

In spite of 15 years of effort there are still causes which result in low utilization of equipment and insufficient improvement in this field. Boleslaw Kierski in "Technical progress in construction in the Five Year Plan 1961-1965," Przegląd Budowlany, April 1959, says:

...." The recent years have so far not displayed any basic improvement despite the constant removal of factors which are still hampering the increase in utilization of machinery. For this reason it is necessary to attain at least 20% increase in utilization of machines during the Five Year Plan. It is estimated that an increase in utilization of the existing stock of machinery of one and a half percent corresponds to replacement of about 3,000 workers".

The causes of this situation are as follows:

- a/ Insufficient home production of equipment and in connection with this, an insufficient quantity of spare parts and units necessary for quick repairs of worn out or broken machines. As a result of this, the time for repairs is relatively very long.
- b/ Mechanization of single processes while the rest of work is still performed manually. This means that the rhythm of the entire complex process is adjusted to the slowest link -- the manual work. Finally, the whole work almost has as long an operational cycle as when performed manually.
- c/ Low standard of mechanical work. The machine operators are not properly trained, the engineers have no experience in the organization of work with machines.
- d/ Neglect of the problem of transportation of heavy equipment, failure to use containers for materials connected with the work of tower and self-propelled cranes.
- e/ Too much propaganda and not enough action on the entire problem of mechanization, failure to create solid economic incentives for mechanization, lack of a quiet long-range plan for a gradual, sound development of mechanization. The demand of the Party for propaganda effects and sensational achievements, which appear afterwards as glittering trifles without lasting value.
- f/ One-sided mechanization, emphasis on heavy types of machines and lack of light maneuverable equipment with several attachments which can perform various work on the smaller scale suitable for medium and small construction projects.
- g/ Neglect of mechanization of skilled work, of finishing and artisan jobs. The time gained by mechanization of heavy rough work is later lost at the time of finishing work.

To improve this situation a longer time and a wise and quiet program is needed,

in which the following should be accomplished:

- (1) Use of Western and not Russian models since Poland does not build many gigantic construction projects and the Western types are more suitable for a medium country and its medium and small construction industry.
- (2) Development and expansion of domestic production of construction equipment, with stress on lighter machines on wheels having several attachments and tools.
- (3) Introduction of a better system of repairs for equipment by using factory-made units and by shortening the repair cycle.
- (4) Lowering the excessive costs of home-produced equipment.
- (5) Assignment of mechanical engineers with university diplomas to the construction industry. Training at the polytechnic engineering institutes such specialists as mechanical engineers for the construction industry.
- (6) Raising the standards for machine operators and their thorough training, granting of special rights and incentives.
- (7) Introduction of a system of economic incentives, liquidation of the present system of "allocation and making presents" of construction equipment.
- (8) Gradual introduction of complex mechanization of earthwork, transportation, concrete and other heavy and labor-consuming work.
- (9) Assigning the direction of the entire problem to experienced construction engineers and economists and not, as today to party secretaries and officials without experience in this field.

(10) Creation of a motor industry which would produce special trucks, dump trucks, tanks, transporters for delivery of prefabricated elements and transport of heavy construction equipment, without which mechanization can not be economical.

(11) Gradual mechanization of finishing and artisan work.

Such a comprehensive program is not in sight. There are some steps being undertaken for the realization of the tasks mentioned in (2), (6) and (11) but this is not sufficient. It should be assumed that there will be some improvement in the next five years because the machine industry has finally started to produce construction equipment (in reality just since 1957), but because of the continuation of the present propaganda and neglect of the other eight important problems, real improvement will not come.

This is a field where the principle is good, but where it is carried out with many faults; a lot of money (but insufficient foreign currency for import of equipment) was spent, and the results are much below what was expected and below what should have been accomplished.

The effort to increase mechanization must be continued. The Five Year Plan 1961-65 foresees the increase of production of the socialized construction enterprises by 46% and the increase of employment only by 22%. Employment in 1965 should amount to 815,000 persons. The difference must be made by an increase of productivity and one of the important elements for such an increase is the allocation of equipment and its better utilization. During the period 1959-65, about seven billion zlotys are to be spent for the mechanization of general and industrial construction enterprises.