Drilling and Blasting Applications at T.K.İ Aegean Lignite Corporation (E.L.İ)

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The drilling and blasting operations are important in mining applications. Specialized and experienced staff and institutions increase the quality, productivity and safety of the work. There are very large amounts of explosives are used in Aegean Lignite Enterprise each year. The analysis of drilling and blasting practices and the costs are presented.

In this paper, the drilling and blasting applications were compared with before and after 1999.

***Key words**: drilling, blasting applications, lignit, cost*

1. Introduction

Organization of Aegean Lignite (ELİ) is established to bring in underground resources like coal and lignite in Türkiye and raw materials needs in order to supply, which is the largest institution of Türkiye Coal Enterprises (TKİ).This resources are produced by ELİ according to the energy policy of states.

Approximately 70 % of lignite production in Türkiye of TKİ, which had apportion of 25 %, is meeting by ELİ. In recent years, up to the present 650 million tons of lignite reserves were found in ELİ's license areas. Average annual 10-11 million tons marketable coals are obtained on to the economy.

2. Enterprise promotion

The central of the Directorate ELİ is located in the county Soma 90 km away of Manisa. The establishment activity in just about amount 23.500 hectares covering the area owned of license TKİ Soma, Deniş, Eynez.

The method production mainly has developed into the underground in the basin in recent years.

Two-thirds of the coal produced are given to Power Plants which are Soma A (2*22 MW) and Soma B (6*165 MW) and have total 1034 MW power. At the same time, it is produced industrial and calandria coal that are need of markets. Substantial amount of coal are separated for Social Assistance and Solidarity Foundation depending on the policy of government.

2.1. The geology of the basin

Soma basic rocks of the basin are greywake paleozoic-aged and crystalline limestone mesozoik-aged. Settled incompatible on the basis neogene sediments are M_1 Miocene basal, M_2 marl, M_3 limestone and pliyosen sandstone, P_{1ab} marl- tuff, P_{2c} conglomerate, sandstone, claystone and P_3 silistifiye limestone series figure 1. The important layer of basin is between M_1 and M_2 layers inthe Km_2 coal seam that average thickness of 20 meters. This shiny black coal has rigid structure and conchoidal curved. There are humidity 12-14 %, ash 26-28 %, sulfur 0,8 – 0,9 % in this coal. Lower heating value is 3500-4500 K.Cal/kg. There are KM_3 coal seams that with plenty of intermediate cut-off and discontinuous in M_3 formation. Low-calorie coal seams KP_1 taked place above, in $P_1 - P_{2ab}$ piliyosen formation. This coal include humidity 20-25 %, ash 45-50 % and lower heating value is 1500-2500 K.Cal/kg.

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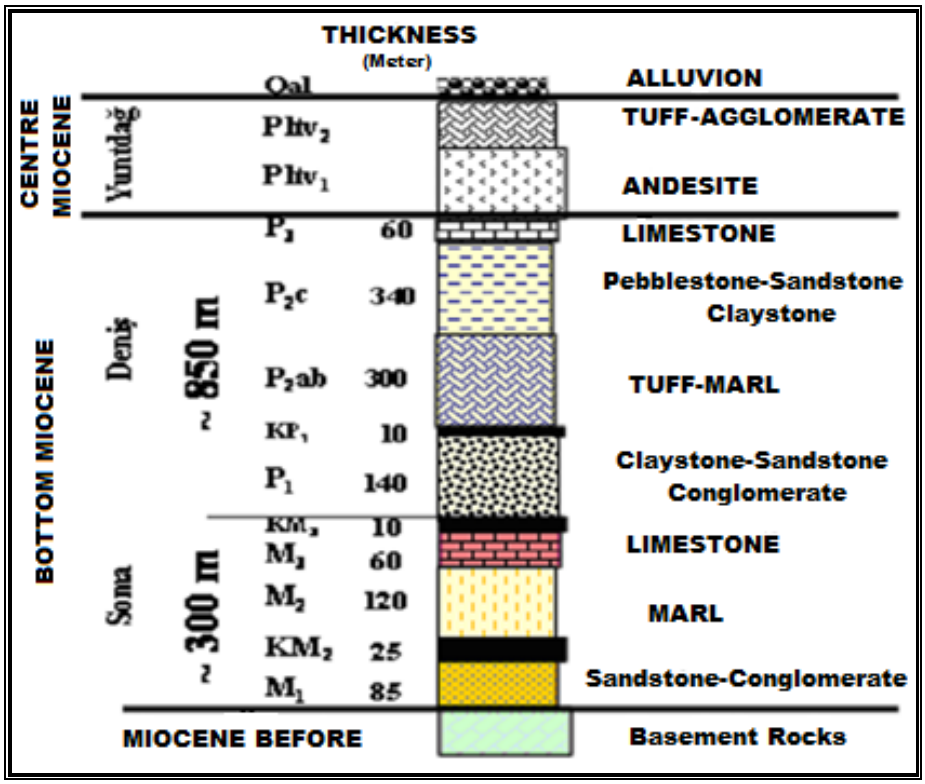

Fig. 1. Geological of basin Soma.

Spread of the coal basin in North East - South west direction Overall slope angle of coal seams 15 to 25 degrees. Basic rocks contains significant geological discontinuitie. Pickling operations, excavated surface punched 9 inches in diameter hole with drilling machine.

Especially, ranges of cracks in limestone and marl formations are filled from 1 to 5 mm by calcite and pyrite. There are pols-volkanik dykes which had neogen activities in some fracture zones.

The formation of vertical crack systems indicates that tectonic activities are stil continuing in the region.

2.2. Production Method

The excavation method is applied moving towards the deep from the surface open mines of Soma basin. The combination of excavator-truck has been preferred in operation. This method was chosen because of layer on the slope of 20 degrees, rugged topography and covering layer had rigid structure and stratified formation. Loosened by drilling and blasting method of covering layer which dug up with17-20 yd3 bucket capacity excavator, sand dump with 85-170 short ton capacity trucks. Distance of dumpsite which varies according to the work area are about 2-6 km. Cover material is general medium-hard marl.

Pickling operations, excavated surface punched 9 inches in diameter hole with drilling machines. The main explosive ANFO are put in these holes. If water is found in holes emulsion explosiver is used. The pattern depends on formation that in general is applied marl 8-6,5m., limestone 7-6m. Step height is prepared 15 meters slices. Length of holes are varies according to the height of the mirror that is between 13 and 17 m.

This machines are used in organization;

- 16 units 15 - 20 yd^3 electric excavator,
- 8 units 2.5 - 6.5 yd^3 hydraulic excavator,
- 21 Units in various capacities, with wheel loaders,
- 10 units 170 short ton truck,
- 98 units 85 short ton truck,
- 26 units 50 short ton capacity truck,
- 12 units road watering trucks,
- 49 units dozer,
- 21 units drill,
- 16 units grader,
- 3 units share dozer,
- 7units road roller,

- 10 units mobile cranes,
- 14 units forklift.

3. Stages of drilling and blasting

Blasting works are being made by special companies since 1998 owing to TKİ General Directorate appropriated this situation. The drilling operations are continued to be held with business opportunities. Efficiency decreased in blasting works of the enterprise because there were irregularities in distances between the rows and of holes, so that between ELİ and Special Company with authorized persons were interviewed and was made a decision employees will be regularly trained. With the aim of increasing efficiency and drilling and blasting applications incorrectly describe, twice a joint training are given, especially technical personnel working in areas including engineering, supervisory, detonators, blasting hole and machine operators, in 2010 by the organization controlled of enterprises and special blasting firm. The importance of job security, introduction of explosive substances, drilling systems in open pits, blasting applications explained during this training. After this training needed care has been taken and distances between the rows of holes and started to be measured by the meter.

Showed that a significant reduction in the number of holes. Although the number of holes had 18.395 in 2009, in an eight-month period, were 8,650 in 2010 and it had been identified that the height of the holes were drilled as regularly.

The process drilling and blasting is carried out six-stage in operation.

3.1 Locating Hole

Site are visited each morning and machines which is the need for rust are identified by a team of preparatory work. Efficiency is evaluated in a previous pulse by observing running machines from mirror of machine. When the pulses are found to be inefficient causes investigated and solutions are sought.

Between hole machine operators and ignitors are done exchange of views about appropriate pattern to formation and length of the drill holes and pulse time. Cross-hole layout is in operation figure 2.

Stoker and drilling machine operators are marked the locations of the drill holes by measuring with meters.

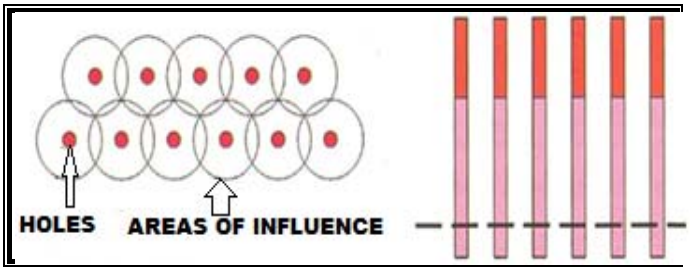

Fig. 2. Cross hole layout, and domain.

3.2. Drilling holes

After hole locations were marked, drilling machines begins to drill the marked locations and Marl formation, 8 m-6.5 m, clay and formation of mixed structures 7 m-6 m, the limestone formations, 7 m-5 m, sometimes with pattern 6 m–4m, 9 inch diameter holes is applied figure 3. According the mirror size and formation, 1 to 1.5 meters deep drilling is done.

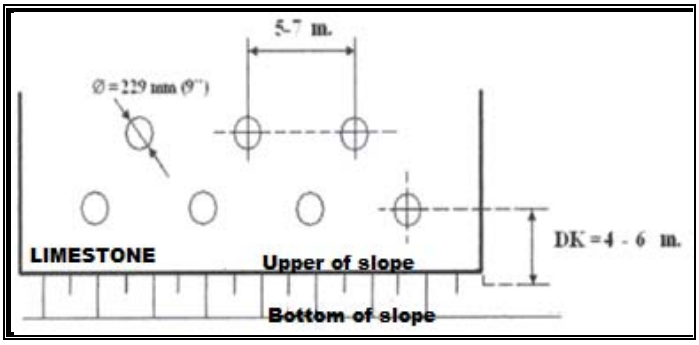

Fig. 3. Layout of the hole in the soft limestone.

There are total of 21 drill holes machines in operation to be 3 the number of wheeled, 18 the number of crawler table1.

Tab. 1. Drilling machines in the enterprise.

PCS	MODEL	BRAND	ENGINE POWER
5	DM50	İ.SOLL RAND	455 HP
7	DM50	İ.SOLL RAND	400 HP
4	SK50-C	REEDRİLL	400 HP
3	SK50-T	REEDRİLL	400 HP
2	35HR	BUCYRUS	450 HP

3.3. Safety and Risk Assessment

After drilling holes, request of blasting are given to the company that had undertaken blow job. There are how many holes, hole sizes, the holes are dry or wet state and pulse time indicated in this request. Risk assessment is done in blasting area by the relevant company's engineer and plant engineer. In this evaluation, elements, is in the area and will be affected by the explosion determined that the machine, truck, human, barracks, power line, the machine power cable, a pump may be, etc...Before breaking, these elements are drawn to the safe distances. If there are a defective machines in blasting area, hole charge will not be made.

Blasting area is closed with buoys and strips to prevent entry and is placed on the warning signs, entries are made with permission. All radio, mobile phones and electronic equipment are excluded from the blasting area. Protective clothing (helmets, vests, goggles, anti-static garments and shoes) is used in full.

Fig. 4. Truck charging

3.4. Charge and blast holes

After work safety measures receiving, the hole charge is started. During blasting, there is an engineer and an ignitor on behalf of business that they check hole charge and safety measures. A form is regulated in the pulse field for each result of blasting. In this form, sketch of the mirror is drawn and the position of hole is marked. In the form, team leader, the igniter, to help the workers, disposal date, disposal location, type of formation, weather, hole diameter, number of holes in dry and wet, mirror size, length of the bore, the pattern, the total amount of ammonium nitrate fuel oil (ANFO) and emulsion, feeder, the ignition cable length, number of capsules are written. In addition, plan of ignition and delay that will be applied for blasting is drawn on this sketch. Hole charges, specially designed for this work carried out by charging trucks figure 4. Charging, in areas off limits to trucks are made with bags. Charging trucks twice a month least 100 kilograms of samples taken weighed calibration of instruments is checked .In addition, the quality of explosives are tested in laboratories by contract on a regular basis every month.

Holes in operation, is charged by two methods without intermediate tightening (figure 5) and with intermediate tightening (figure 6).

The charge method is determined according to length of the bore and the formation.

The methods without intermediate tightening; 1.5 kg (bait) dynamite placed on the bottom of the hole after ANFO is a little charge made on the additional 1kg bait (dynamite) again made some ANFO charge are finally tightening. This charging method is simple, shorter duration of labor.

With intermediate tightening method; After 1.5 kg dynamite sensitive to capsule is made charge in the base of hole, is filled in on the ANFO. The rust hole is poured on top of the ANFO 2-3 meters. On top of the rust 1 kg

dynamite sensitive to capsule and on top of this ANFO is charged. The rest of the hole again the rust hole is poured on top tightening. The tightening length of about 7-8 m. The charging method with tightening is applied in a longer time and wants to be more careful duration of labor.

In business; Electrical ignition system and components are preferred because of to be safe and achive the desired delay and the influence of environmental. After all the holes have been charged, factors identified in the risk assessment shall be in safety distance. If there is risk region, personnel sent there. The staff notifies ignitor with audio and pennants safety status of the area. Roads are closed, blasting close to the barracks emptied. Anyone who is close to area is warned stolen siren. After blasting team freed up space, igniter pulls the ignition cable distance to 250 - 300 meters and makes magneto link. Ignitor is takes the sign blasting area is safe and makes ignition again by playing siren.

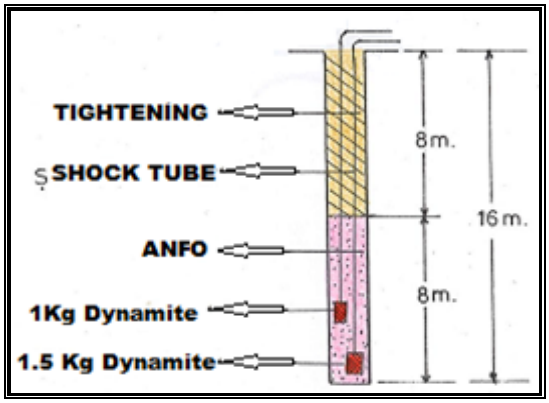

Fig. 5. Without intermediate tightening charging method.

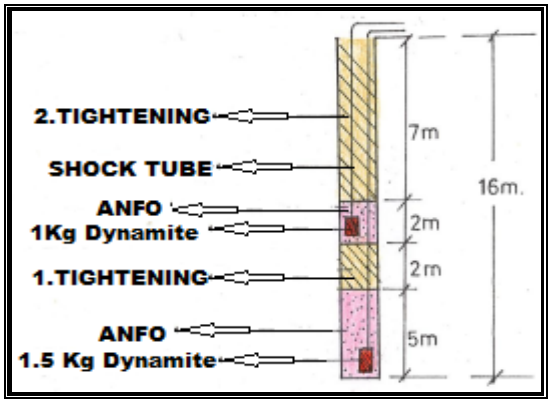

Fig. 6. With intermediate tightening charging method

3.5. Field control after blasting

After blasting is done at least 5 minutes blasting area is controlled by of business blasting the control engineer and the company's blasting engineer.

If there are unexploded hole, are determined and are made in accordance the explosion.

After the explosion the size of the piece, cracks in the rock back other than blasting limit, projection of stone vs. subjects evaluated, pulse output is controlled. If the area has been determined to be safe, the work is started.

3.6. Analysis of Blasting

After blasting; pulse location, hole size, number of holes, hole diameter, the amount of explosives used, data such as tightening the tribes and the number of capsules are written to monitoring records. Stripping calculation is done to destroy its main boards based on monthly and annual for quantities of pickling. Boards assessment is made specific charge amounts are determined. Blast analysis calculated separately for each panel table 2.

Tab. 2. Eynez in 2009, Sarıkaya, Işıklar, and Deniş boards blasting analysis.

Actual Data	Eynez	Sarıkaya	Işıklar	Deniş
Annual Stripping (m^3)	11.242.000	3.209.000	6.234.000	5.684.000
Blasting the main Stripping (m^3)	7.824.000	2.118.000	790.266	2.561.000
Anfo (Kg)	1.631.245	409.775	50.925	320.435
Emulsion (Kg)	45. 578	7.090	87.354	253. 714
Anfo + Emulsion (Kg)	1.676.823	416.865	138.279	574.149
Anfo Charge (Kg/m)	0,209	0,193	0,064	0,125
Emulsion Charger (Kg/m^3)	0,006	0,003	0,111	0,099
Anfo + Emulsion Charger (Kg/m^3)	0,214	0,197	0,175	0,224
Hole Number (pcs)	8.117	2.133	1.690	4.973
Total Hole Length (m)	111.458	30.172	13.906	45.184
Average Hole Length (m)	13,73	14,15	8,23	9,09
Meters Per Unit Charge (Kg /m)	15,05	13,82	9,94	12,71

4. Cost of drilling

Aegean Lignite divided into four to clipboard in terms of drilling and blasting work to be Eynez open pit board, Işıklar board, Sarıkaya board, and Denis boards.

4.1. Drilling cost calculator

In 2009, drilling jobs was carried out by staff ELİ and equipment. Calculating the cost of these procedures is given in table 3.

Table 3. The cost of drilling costs (in 2009).

COSTS	HOURLY COST (¨/h)
Labor	27,42
Diesel Fuel	69,10
Repair and maintenance	7,83
Spare parts	30,75
End consumption	6,63
Oil consumption	2,83
Depreciation	71,18
Other expenses	39,54
TOTAL	255,18

Hole drilling machines in 2009, a total of 9305 hours of operation h,
The total hole length = 211694 m. The total hourly cost = 255,18 ¨/ h
The average length of the bore of a rotary hammer, a breach of an hour = 211694 / 9305 = 22,7 m
Drilling Cost = 255,18 / 22,7 = 11,24 ¨/ m amounts to.

4.1.1. Labor

In 2009, there were a total of 14 drill operators in the enterprise. These operators are as the average monthly cost of ¨57.036 calculated. Workers total of one month working time 2080 h.
Hourly Cost = Total Labor / Working Time = 57036 / 2080 = 27,42 ¨/h

4.1.2. Fuel consumption

Drilling machines total of diesel fuel consumption 364.792 liters work is started per liter diesel ¨1.76229.

Total Fuel Cost = 364792 * 1.76229 = 642869,29 ¨

Hourly Fuel Cost = 642869,29 / 9305 = 69.1 ¨/h

4.1.3. Repair maintenance

21 rotary drills which were used in business that 19 of them has been completed economic life. It was taken into consideration depreciation charge of last received two rotary hammers.
Repair and maintenance cost = (0,2 * R * A) / NR

R: Repair factor = 0,55
A: The machine cost = 1.423,71 ¨(It is based on that depreciation charge of two drills that are last received)

NR: Depreciation Period = 20.000 h
Hourly Cost = (0,2 * 0,55 * 1423,71) / 20000 = 7,83 ¨/h

4.1.4. The cost of spare parts

Spent for drilling machines the total cost of spare parts 286.209,70 ¨
Hourly Cost = 286209,70 / 9305 = 30,75 ¨/h

4.1.5. The consumption end of hole machine

There are a total of 35 extreme consumption of drilling machines.

One End Cost = 1.765 ¨

Total End Cost = 35 * 1765 = 61.775 ¨

End Hourly Cost = 61775 / 9305 = 6,63 ¨/h

4.1.6. The consumption of oil

Drilling machines used motor oil, hydraulic oil, compressor oil, and grease oil, draw oil a total expenditure of 26.342 ¨.

Oil Hourly Cost = 26342 / 9305 = 2,83 ¨/h

4.1.7. The cost depreciation

There are 21 hole drilling machine in operation. 19 machines have not been taken into account because of economic life is complete.

2 rotary drills of Bucyrus brand

Cost = 1.423.710 ¨ economic working life 20.000 h

Depreciation cost = 1423710 / 20000 = 71,18 ¨/h.

4.1.8. Other expenses

Other expense cost = (A * 0,1) / 3600 = (1423710 * 0.1) / 3600 = 39,54 ¨/h

A: The cost of machine

4.2. Cost of Blasting

Blasting expenses calculated in operation over billings paid company, according to the agreement made with firms undertaking blasting work.

ANFO and emulsion, all expenses of the company in the contract price by contract. Therefore, ignition components and the firm's labor cost are not calculated separately. However, it is taken into account that labor annual cost of the nine employes igniters whom are working in ELİ and are given in table 4.

Tab. 4. The cost of expenses of blasting in 2009.

Expenditure	Amount (Kg)	Amount (¨)
Anfo	2.497.870	3.826.401,35
Emulsion	425.036	986.075,80
Labor (9 Ignitor)	-	508.140,00
TOTAL	2.922.906	5.320.617,15

In 2009, hole total of 211.694 meters blown burst. Blasting cost per meter;

Blasting Cost = 5320617 / 211694 = 25,13 ¨/m on the account.

4.2.1. Cost of Anfo

In 2009, the total amount = 2.497.870 kg Anfo and the blasting company ¨3.826.401,35 was paid to progress.

4.2.2. Cost of Emulsion

In 2009, 425.036 kg the amount of emulsion used in the blasting company was paid progress payments amounting to ¨986.075,80.

4.2.3. Labor cost

9 igniter of the operator are casual staff title containing the year 2009 is the total cost ¨508.140.

5. ANALYSIS OF BURSTING

While 1991-2009 between the years analysis of drilling and blasting is made of 1999 the pre-and after the comparison.

In operation 1991-2009 between the total excavation, to explosion basis excavation, the amount of explosives used, number of holes, hole length, the unit charges, consumption of the ignition components in Table 5 to 6 are also given.

Tab. 5. 1991-1999 between years of data from drilling and blasting.

GENERAL DATA / YEARS	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Actual Excavation (m^3)	25.030.200	33.535.598	34.217.622	35.266.002	35.715.727	34.937.450	32.633.519	34.810.470	35.651.000	301.797.588
Explosion Basis Excavation (m^3)	21.626.000	29.375.000	27.595.000	26.574.000	22.175.000	22.263.000	25.738.000	24.066.000	24.749.000	224.161.000
Total Anfo (kg)	7.179.539	10.962.520	10.479.902	10.481.810	8.121.720	7.532.360	9.062.544	4.830.995	4.421.168	73.072.558
Unit Charge in Anfo (kg/m^3)	0,332	0,373	0,380	0,394	0,366	0,338	0,352	0,201	0,179	0,326
Total Emulsion (kg)	0	0	0	138.500	340.200	477.100	461.892	2.469.129	2.620.917	6.507.738
Unit Emulsion charge (kg/m^3)	0	0	0	0,005	0,015	0,021	0,018	0,103	0,106	0,029
Anfo+Emulsion (kg)	7.179.539	10.962.520	10.479.902	1062*310	8.461.920	8.009.460	9.524.436	7.300.124	7.042.085	79.580.296
In Anfo charging unit + Emulsion (kg/m^3)	0,332	0,373	0,380	0,400	0,382	0,360	0,370	0,303	0,285	0,355
Bait dynamite (kg)	115.810	207.330	432.075	85.840	59.290	52.000	45.150	51.495	60.443	1.109.433
Electric Capsules (PCS)	40.700	39.332	28.805	31.830	26.417	45.129	23.989	22.501	20.168	278.871
Unpowered Capsule (PCS)	0	0	0	0	377	15.728	0	0	0	16.105
Cable (m)	149.920	45.180	28.630	23.860	38.850	58.335	55.898	86.480	9.567	476.720
Number of Holes (PCS)	43.218	55.547	51.898	48.822	41.565	43.922	48.802	47.513	51.612	432.899
Total Pore Size (m)	600.686	816.161	766.742	738.272	615.889	618.304	715.079	668.404	687.339	6.226.876
Average Hole Size (m)	13,90	14,69	14,77	15,12	14,82	14,08	14,65	14,07	13,32	14,38

Tab. 6. 2000 - 2009 Years of drilling and blasting the data from.

GENERAL DATA / YILLAR	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Actual Excavation (m^3)	36.750.924	32.600.000	29.078.835	28.484.301	29.033.950	28.332.000	28.272.000	27.283.000	28.617.000	26.369.000	294.821.010
Explosion Basis Excavation (m^3)	28.464.727	25.315.836	26.831.477	22.605.274	20.797.193	23.489.273	25.296.075	22.831.645	16.049.786	13.189.065	224.870.351
Total Anfo (kg)	5.425.769	5.562.420	4.627.920	4.626.545	3.796.070	4.817.000	4.984.000	4.683.000	3.192.246	2.497.870	44.212.840
Unit Charge in Anfo (kg/m^3)	0,191	0,220	0,172	0,205	0,183	0,205	0,197	0,205	0,199	0,189	0,197
Total Emulsion (kg)	1.496.045	609.356	2.060.435	949.000	798.050	580.645	1.271.753	548.709	661.018	425.036	9.400.047
Unit Emulsion charge (kg/m^3)	0,053	0,024	0,077	0,042	0,038	0,025	0,050	0,024	0,041	0,032	0,032
Anfo+Emulsion (kg)	6.921.814	6.171.776	6.688.355	5.575.545	4.594.120	5.397.645	6.255.753	5.231.709	3.853.264	2.922.906	53.612.887
In Anfo charging unit + Emulsion (kg/m^3)	0,243	0,244	0,249	0,247	0,221	0,230	0,247	0,229	0,240	0,222	0,238
Bait dynamite (kg)	82.432	80.524	79.952	70.379	67.988	69.260	72.818	63.367	48.269	38.137	673.126
Electric Capsules (PCS)	7.680	4.211	2.712	2.358	2.462	3.024	2.489	1.972	885	1.327	29.120
Unpowered Capsule (PCS)	88.168	96.712	95.451	84.667	75.880	87.384	87.674	76.917	62.394	43.893	799.140
Cable (m)	149.920	45.180	28.630	23.860	38.850	58.335	55.898	66.480	9.567	47.777	524.497
Number of Holes (PCS)	41.118	35.099	36.555	32.557	28.865	32.570	35.278	32.648	23.156	18.395	316.241
Total Pore Size (m)	521.332	463.660	491.419	414.016	396.137	466.057	481.830	418.162	283.065	211.694	4.147.372
Average Hole Size (m)	12,68	13,21	13,44	12,72	13,72	14,31	13,68	12,81	12,22	11,51	13,11

Between 1991–2009 years made a total of 596.6 million cubic feet stripping by ELİ. In contrast 133.2 million kilograms of explosives were used. In recent years draws attention substantial reductions in the amount of explosive used figure 7-8.

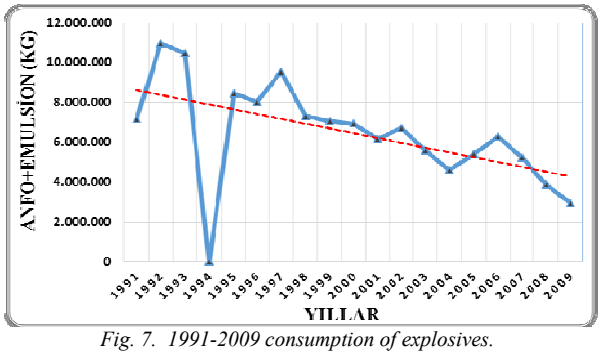

Fig. 7. 1991-2009 consumption of explosives.

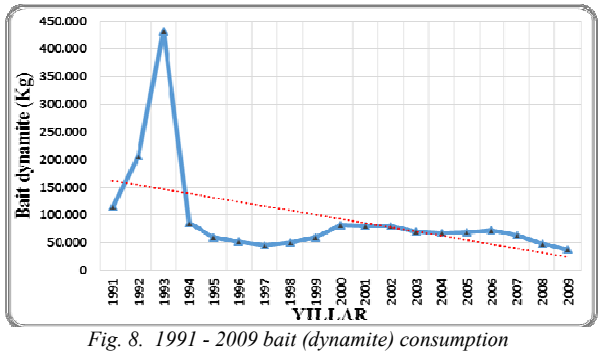

Fig. 8. 1991 - 2009 bait (dynamite) consumption

1991-1999 Between consumption of the explosive was 8.9 million kilograms per year, 2000-2009 between decreased up to 5,6 million kilograms per year. In 2009, the total amount of explosives was 2.9 million kilograms.

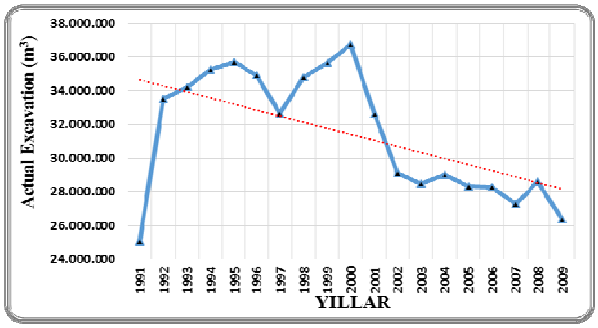

Fig. 9. 1991 - 2009 the amount of stripping.

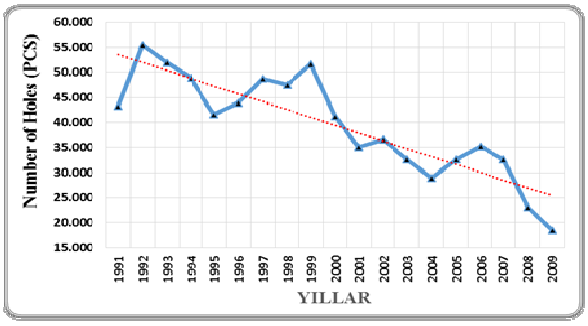

Fig. 10. 1991-2009 the number of holes.

The number of staff fall from 4500 until 1800, reduction in the number of trucks, to continue work with machines and trucks that have completed economic life are shown as the most important reasons of reduction in the amount of stripping figure 9.

Striking values emerge, when number of holes (figure 10) and hole size (figure 11) that before and after 2000 are examinated.

In 1992, 55.547 holes are drilled. The total lengths of these holes are 816.161 meters. The amounts of the pickling are 33.535.598 m3.

2009 data are examined; total 18,395 hole is drilled, the total length of these holes are 211.694 meters and the corresponding seen that the amount of stripping is 26.369.000 m3. The number of holes in 1992 are three times the number in 2009, the total length of the bore are nearly four times of 2009.

However the two-period stripping is compared, these rates were not observed in the same way.

The pore size that operators indicate at the end of the shift and immediately was recognized that are datas of drilling and blasting. However, the actual hole size as measured in the field with hole sizes of operators reporting between observed differences. Also determined to destroy its main pickling, stripping all of the excavators is regarded as essential to explode. Whereas machines without blasting are studied. Sometimes tea plantation landslide, sometimes loose materials.

Sarıkaya open pit board blown total of 6 holes, 15 meters in length, 8m-6.5m pattern holes in April 2010. Here be obtained the amount of material approximately 4000-5000 m3. Board were made a total of stripping 259.000.000 m3 during these months. This shows that all stripping not made by blasting.

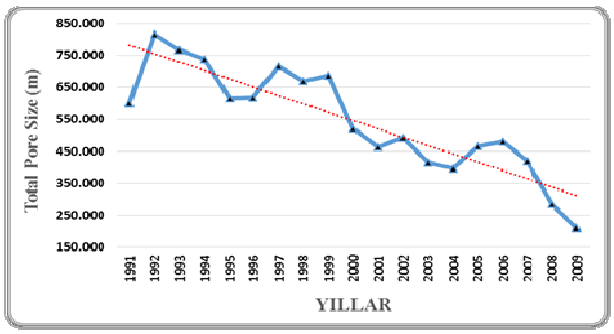

Fig. 11. 1991-2009 the length of the hole

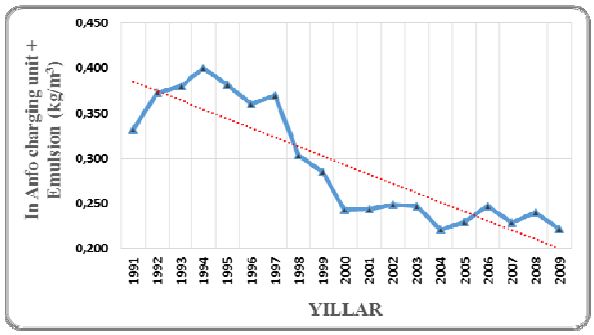

Fig. 12. 1991-2009 Unit charges.

For the year 2009 statistical analysis was conducted using actual data from the field. The main pickling to explode were found stripping landslide and without blasting excavation areas subtracting from the total stripping. The application pickling was made 26.369.000 m3 in 2009. But, it was calculated as 13.189.065 m3 that the pickling based on blasting.

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This value, is realized by half of the actual stripping, was very low compared to other years. In addition, the amount of charging units was level of 222 g/m3 very low compared to other years.

Table 4-5 are examined shows that; while the charge per unit of 355 g/m3 between1991–1999 years, between 2000–2009 years 238 g/m3 at the level figure 12.

6 Conclusions and recommendaations

Aegean Lignite as a public institution provided important contributions the country's economy for years.

ELİ has taken its place as the largest industrial enterprise eighth in Aegean, in Turkey 55. in 2010.

However, significant decreases occurred the number of personnel and machinery park because of the necessary investments was made the lack of timely. Due to personnel shortages and affordability procurement system organization saw appropriate that the blasting jobs be made by professional teams. Therefore, it has been making blasting jobs the blasting companies with tender since 1998.

According to the agreement made between the business and the company, occupational health and safety completely be the responsibility of the company concerned indicated. In addition, defects in blasting works and sanctions to be applied in this regard determined by contract. Accordance with the contract, by the enterprise to drill the holes, storage of explosives, transport, holes in the charge, tighten and blowing up the job is related to the company. How the holes will be charged and the amount of explosives will be put in every hole determined by the operating personnel.

As a result, between 1991-1999 years explosive unit charges average of around 355 watched gr/m^3 by ELİ operator, between the years 2000-2009 has decreased to levels of 238 gr/m3.

Whereas, between 1991-1999 years the amount of rust from per hole, 520-530 m^3/hole, average of the years 2000-2009 took place between 700-720 m3/hole. The number of holes drilled, hole sizes and quantities of explosives used in seen that significant reductions. The correct application of pattern and blasting jobs are done by expert organizations indicate that it is very importance for operator drilling- blasting practices and in the years 2000-2009 were won significant material.

At the plant, improving the quality of the work done and the cost is reduced recommendations for more economic and more secure;

1. Distance between holes determined by measuring with meters to drill the holes. Such as every inch measured in the wrong redundant boring of holes are caused, brings the operation significant costs.
2. After the holes are drilled, of pasha around the hole withdrawal from the mouth of the hole or appropriate plug until the moment of detonation the holes delayed covered with caps prevents wind hole factors such as rain back filled the efficiency of hole falling.
3. After drilling, as possible quickly should blast because of influencing explosions surrounding holes.
4. The drilling holes and blasting work should be preferred as much as possible throw of open the mirror. In this way, can be measured more healthy bore the burden.
5. The holes should be checked night and made cautionary markings to avoid the risk of deterioration drilled holes by machines running at night shifts.
6. The holes should be drilled in accordance to the height of the mirror, otherwise, short-drilled holes cause loss of time with the ripping and creating nail.
7. The staff working in the field periodically should be educational courses and reminder and provided to comply with for occupational health and safety rules.
8. Drilling and blasting data must keeping a clear with metric dimensions. For this all the time actual values taken from the field (hole size, number of holes, pattern, etc.) should be used, estimated data should not be taken into account measurements aren't made. Details should be specified clearly for finding stripping to destroy the basis and without the need to destroy.

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