MODELING SMALL SURFACE COAL OPERATOR TO STUDY THE EFFECT OF GOVERNMENT'S PERMITTING AND BONDING REVIEW PROCESS

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ABSTRACT

This paper presents the discussion and the application of system dynamic methodology to study the consequences of government regulations on small surface coal operators. In 1977 Congress promulgated the Surface Mining and Reclamation Act, which brought about some critical changes such as lengthy and costly permit preparation procedures, lengthy local and state review of permits and lands, increased bond fees and costly reclamation requirements. Small surface coal operators appeared to be particularly vulnerable. Policies frequently considered by the surface mining industry and the government to alleviate the hardship caused by the regulations are mechanisms to offset increased bond fees. It is a purpose of this paper to demonstrate the utility of system dynamics as any effective methodology to study the long term effects of such policies.

INTRODUCTION

This paper studies the consequences of government processing delays on small surface coal operators. The study is done with the aid of a system dynamic model developed at Michigan Technological University. It includes a relatively detailed

representation of the functional areas of a small coal operator and an aggregate representation of the coal market, lending institutions and the government. The model structure describes land management, the physical flow of coal, equipment capacity management and money management. Inherent in this structure are the policies utilized by the small operator in monitoring and controlling coal production and distribution, land resources, equipment utilization and money flows. The external entities in the small operator's influencing environment are the coal market, lending institutions and government. Coal markets influence the flow of coal shipments and revenue. Lending institutions influence the flow of money by controlling debt, interest rates and bond payments. Government has traditionally influenced money flows via taxes. Recently though, government extended its monitoring and control capabilities by promulgating the Surface Mining Control and Reclamation Act of 1977 (PL 95-87) [1]. This law mandates that coal operators include permitting and bonding policies that modify their traditional land management practices.

In order to develop a realistic model, small surface coal operators in six states were visited to study operational activity, local permitting and bonding review procedures, their relationship with banks and bonding companies, and most importantly, their decision-making rules. Specifically, one Pennsylvania operator agreed to our use of his operation in forming the model's basic structure. Information gathered at the other mines was used to verify the adaptiveness of this basic structure to each operation. Other contributors to the formation

of the model were a coal broker, a strip mining and engineering consultant and two banks, all located in the western Pennsylvania region. Follow-up interviews with the Pennsylvania operator and one bank were conducted after the model was completed for validation purposes. Model results and the resulting recommendations concerning the permitting and bonding process concurred with the recommendations of a Penn State University study on small coal operators also.

For the purposes of this paper, in order to understand the influence of scale of the surface coal operation, two different sized small coal operators were selected: 1. 50,000-100,000 tons per year and 2. 100,000-200,000 tons per year. The monetary resources vary, of course, between large and small operations. For this reason the impact permitting and bonding delays have on the cash flows of different sized operations also vary.

This paper analyzes the different bonding and permitting-related policies. These are 1. reduce the state bonding fee from $4,000 per acre to $1,000 per acre, 2. increase the bond retirement rate by reducing the time to retire a bond from sixty months to thirty months and 3. hold the permitting and bonding delays to existing time delays while retaining the state bonding fee at $4,000 and the time to retire a bond to sixty months.

BACKGROUND AND SCOPE OF THE PROBLEM

The problem addressed here can well be described with the help of a causal diagram presented in Figure 1. The situation prior to passing of PL 95-87 Act is displayed by variables and their interrelationships enclosed in the upper-left triangle. The structure in this triangle basically represents classic supply-demand relationship. The next two paragraphs put it in historical context.

In the 70's a resurgence in demand for coal was evident, and to match this demand the most dramatic increase in production has come from surface mining [2], [3]. The percentage of U.S. coal production from surface mining has grown from approximately forty-five percent in 1962 to over sixty percent in 1978. Much of the growth in coal demand was due to the decline in domestic oil and gas reserves and perceived uncertainty in foreign oil supply. Many forecasted an extended growth trend in demand for coal. Several government-initiated programs further reinforced the belief that the coal industry could occupy a prominent role in the energy sector of this country.

During this period of speculation, there was an influx of small coal operators into the industry. Production began to outplace demand, glutting the coal market and keeping the lid on prices. Meanwhile, mining costs continued to rise reducing profit margins to critical levels. However, the mining methods many new entrants into the industry employed scarred the land, polluted the streams and stimulated the push by the Office of

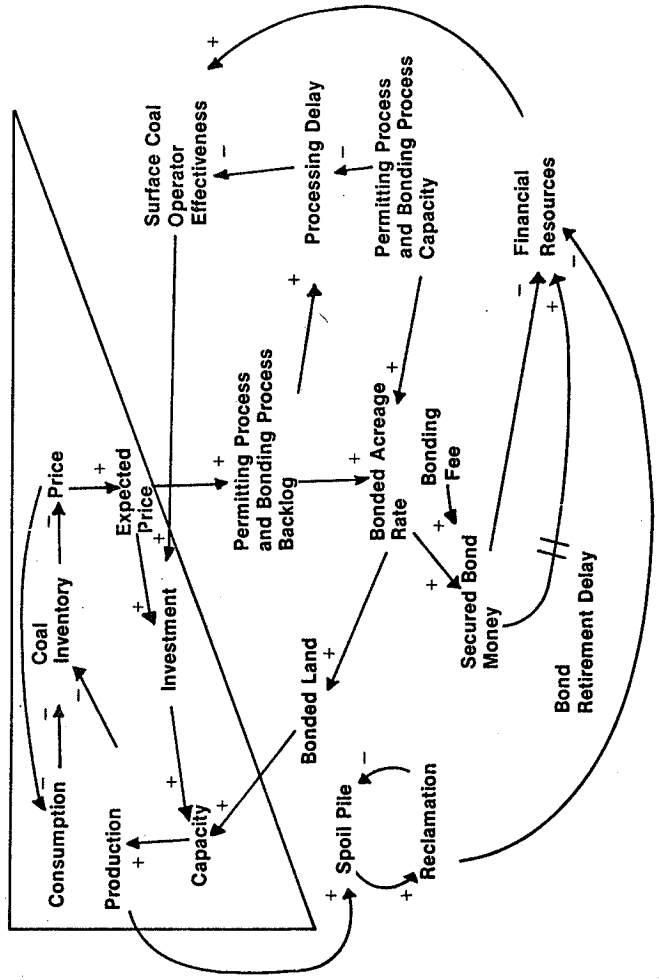


Figure 1. The Dynamic Feedback Structure of Surface Coal Industry
As Perceived by Coal Operators

Surface Mining (OSM) and Congress to create and pass PL 95-87. Unfortunately, though, many qualified, experienced and responsible operators who were an asset to the industry also got caught in the final squeeze created by the law. PL 95-87 was tagged as the untimely reason many got pushed over, though many failures were inevitable due to unfavorable economic conditions.

The effect of PL 95-87 is described by variables and their relationships among themselves and with the variables enclosed in the triangle is also shown in Figure 1. Compliance with the regulations has often created prohibitive costs for many small operators. Lengthy and costly permit preparation procedures, lengthy local and state review of permits and bonds, increased bonding fees and costly reclamation requirements are a few of the more critical changes the regulations have brought about. Many marginal operators did go out of business. These operators were already close to the edge of failure due to the unfavorable economic conditions. In 1979 hundreds of small operators in the Appalachian region alone went out of business [4]. The pressure began to mount on the government to take appropriate steps to alleviate some misery. The reduction in the state bonding fee and the reduction in the time to retire a bond were among the policies suggested. However, though reduced effectiveness with which small coal operators can operate was evident, it was not clear whether policies as suggested above would have any influence. The reduction in effectiveness could very well be due to unfavorable economic conditions. The questions are: 1. What

if there is sustained increase in demand? 2. How does the scale of surface coal operation have influence on effectiveness?

The scope of the problem being studied here is limited to answering these questions. For this purpose a relatively detailed structure representing functional areas of small coal operators was necessary. The next section describes the model structure, which is followed by a section on applications of the model to track the behavior of important variables to study the effect of policies mentioned in the last section.

MODEL STRUCTURE

Land management is the area within the small surface coal operator system that government has felt the greatest need to monitor and regulate. The government's objective is to insure that the operators refurbish the land to its premining condition. The government's method of regulation is based on issuance of permits and bonding requirements. This introduced a disciplined approach to land management. However, the effect of the decisions made in land management in response to government regulations radiated throughout the production and finance areas of small operator.

Land Management Changing the form of the land is a physical process; changing the status of the land is a required regulatory process. Land status must change after the land is acquired and before stripping begins in order to comply with PL 95-87. After a tract of land is acquired, it must achieve "permitted" and then

"bonded" status before stripping can commence. This entails completing mining and drainage permit applications for review and subsequent approval by local and state agencies. Attainment of permitted status is followed by procedures to bond a portion of the newly permitted land. The useful life of a permitted section of land is much longer than a bonded section. Due to the large monetary outlays associated with bonding ($2,000-$4,000 per acre), only a section within the permitted area is bonded at any one time. Acreage equivalent to the small operator's yearly stripping rate is the minimum bonding requirement. Bonded status is also preceded by the review and subsequent approval of the bond by local and state agencies.

The foundation of sustained growth for small surface coal operators is the acquisition of sufficient land and reserves. The stripping rate determines what is a sufficient rate of acquisition. Once the coal underlying a parcel of land has been exposed by stripping and mined, that parcel of land has no future potential in regards to coal production. In order to compensate for this continuous depletion of reserves, land must be acquired at a rate comparable to the stripping rate. If not, the life of the mine and the company will continuously decline. The ability to acquire sufficient land and reserves is expected to become a problem for small surface coal operators in the East within ten years [5]. Figure 2 illustrates the feedback loop used in this model to produce growth within the land management sector along with the delays associated with changing the permitted and bonded

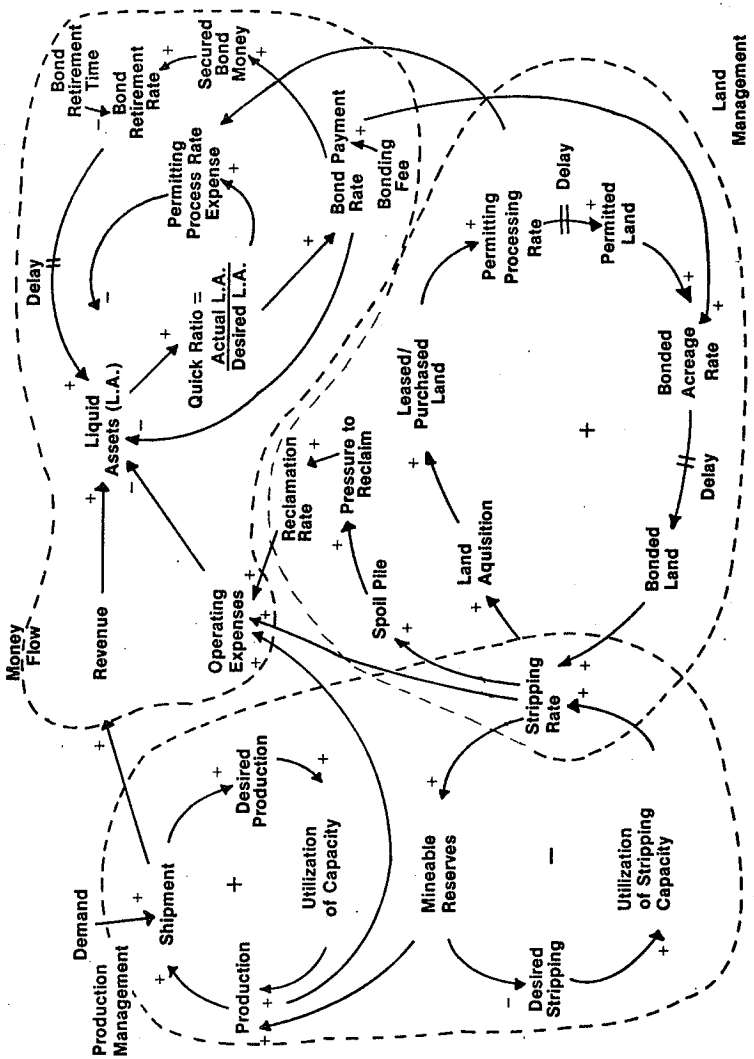


Figure 2. Causal Loop Diagram of Small Surface Coal Operator

status of the land. The delays inherent in the permitting and bonding process are the most critical variables in this model. As the "paperwork and processing time" or the "bonding process time" is increased, the permitting process rate and the bonding process rate, respectively, decrease. Once this occurs, the gain previously observed in this positive loop becomes a degenerative loss. If the behavior is not controlled, the level of bonded land approaches zero, eventually halting the stripping rate and production.

Production Management Overburden must be stripped off before the coal underlying it can be mined. If the production rate exceeds the stripping rate, the level of mineable reserves (exposed coal) will eventually decrease to a point where production must be halted until more overburden can be stripped away. At this point, since there is no production, coal stockpiles begin to diminish. Shipments will eventually decrease if production cannot resume, decreasing revenues from coal sales. This squeeze on production resulting from an inadequate stripping rate can occur if the production rate exceeds the stripping capacity, or, if the level of bonded land is inadequately maintained due to processing delays or excessive costs. If land is not bonded, a coal operator can not legally begin stripping.

The decision to adjust the stripping rate based on the level of mineable reserves is illustrated in Figure 2. The negative feedback loop captures the process of matching the actual stripping rate with the desired stripping rate. The rate

of exposing reserves and the stripping rate are identical variables with different units. The stripping rate is in acres per month while the rate of exposing reserves is in tons of coal per month. There is an acceptable conversion between acres and tons of coal based on the seam height and number of acres. The conversion states there is approximately 1,742 tons of coal per acre-foot. Multiplying this figure by the seam height and the number of acres, a conversion from acres to tons of coal is made. Thus as the stripping rate increased, the rate of exposing reserves also increases. This results in an increase in the level of mineable reserves. The level of mineable reserves is compared to a constant goal, desired mineable reserves. If the level of mineable reserves is below the desired level, a position adjustment in the stripping rate is made. This is accomplished via the correction for mineable reserves. If the level of mineable reserves is too low, a positive correction for mineable reserves is made. A positive correction results in a positive increase in desired stripping, increasing the utilization of stripping capacity. Utilizing more stripping capacity increases the stripping rate, eventually creating an increase in the level of mineable reserves. Once mineable reserves coincides with desired mineable reserves, adjustments in the stripping rate will cease.

Although the level of mineable reserves has a strong effect on the stripping rate, the level of bonded land has an even

stronger impact. Even though we may need to adjust the stripping rate to increase the level of mineable reserves and maintain the production rate, if the level of bonded land is low or non-existent, the stripping rate will have to decrease or stop regardless of the internal pressures to increase it. Figure 2 demonstrates how land management's positive feedback loop is competing with the goal-seeking negative feedback loop for dominance and control of the stripping rate.

Impact on Cash Flow The functional area most closely monitored in any business is the financial control sector. Most decisions eminate from this sector and radiate out to all areas of a business. Financial decisions are made for the purpose of hedging against conditions outside the control of the decision-maker that influence financial behavior. For instance, the small coal operator has little or no control over inflation, interest rates, demand for coal, bank loan policies or cost-bearing government regulations. While interest rates and costs are rising (or were), prices are falling and bank loan decisions varying, what effect will different government regulatory policies have on the financial behavior of the small coal operator? The causal diagram in Figure 2 illustrates where government policies intercede in the small operator's finances, creating behavior that radiates throughout his entire system.

The government regulation that creates the largest drain on the small operator's cash flows is bonding. Although the money securing the bond is eventually returned to the small operator,

the problem lies in the length of time between purchasing the bond and retiring the bond. It currently takes five years before a bond is retired and the money is returned to the small operator; that is assuming there have been no citizen's complaints contending the operator has not adequately reclaimed the land and water. If such complaints exist and are substantiated by an OSM inspector, the five-year retirement period starts over again. Twenty acres of land is what an average-sized small operator mines yearly. The cost of a bond for one year for an operator of this size would range between $40,000 and $80,000, depending on which state the land exists in. Consider $80,000 being taken out of the cash flows of a highly leveraged business yearly and not recovering the money for a minimum of five years. At the end of the five years, a newly established operation will have put up $400,000 before its first $80,000 is returned. The bond payment rate depends on the image the operator projects to a bonding company. If a bonding company will back a particular operator's bond, the operator may then only pay five percent of every $1,000. On the other hand, if the operator is inexperienced, has never dealt with the bonding company before, has an unstable financial position or has a bad reputation in the local mining community, the operator will probably be denied backing by the bonding company. The operator must then assume the total financial burden himself.

Money expended for the purpose of preparing a permit can average between $50,000 and $60,000 per year for a small

operator. Permit expenses are a burden placed by the government on the operator to insure that proper mining techniques are employed and safeguards against spoiling the land and water have been taken. Payments for preparation of permits are never reimbursed.

Counteracting the drains on liquid assets through permitting and bonding are the revenues realized through coal sales (Figure 2). Oftentimes these revenues are insufficient to justify the purchase of a new bond due to increasing operating expenses or a depressed coal market price. If a new bond cannot be purchased, stripping will have to be curtailed. Following a declining stripping rate will be a decline in production and shipments, resulting in decreased revenues. By not purchasing a bond, the operator is wagering that the coal underlying his declining level of bonded land will last long enough to bring in the necessary revenues to afford a new bond in order that mining can continue. This strategy or predicament is extremely risky during a period of faltering demand, rising cost and stagnate prices.

Another strategy frequently observed when a small operator's expenses are outpacing revenues involves cutting back on reclamation and its associated expenses long enough to regain solvency before OSM inspectors order him to resume normal reclamation activities. As shown in Figure 2, reclamation monetarily contributes only to operating expenses. The long term contribution of reclamation is the preserved beauty and

productivity of the land and water. To the small operator who is in a short term financial squeeze, reclamation is the one activity in the mining cycle which can be curtailed without decreasing production. Two forces act on the reclamation rate; one is internal and the other external. As explained if the financial performance of the operation is waning, the tendency is for the operator to cut back reclamation in order to regain solvency. Opposing this internal force are government regulations and government inspectors. If the level of spoilpile acreage becomes excessively high, government inspectors will release an order to resume reclamation regardless of the operator's financial condition. To a point then, the internal force dominates the external force and spoilpile acreage is allowed to increase. Once the spoilpile acreage level exceeds a particular inspector's criteria, the pressure to reclaim begins to dominate, requiring reclamation and its drain on liquid assets to resume.

APPLICATIONS

During a sluggish coal market in 1979-80, the processing times for reviewing a permit and a bond stood at twelve and one month, respectively [5]. These processing times were already excessive and caused problems according to the small operators interviewed. There were also considerations emerging from the review agencies of extending the reviewing process. This raises a question: If the reviewing process during the sluggish coal market is already lengthy, what will happen if or when the demand

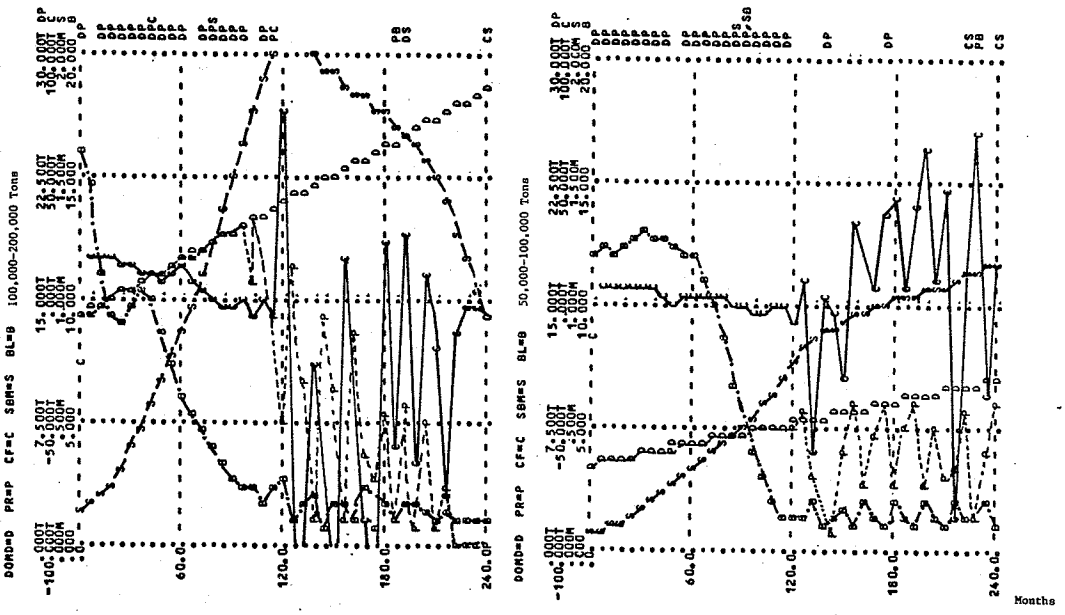
for coal begins increasing steadily? The assumption is that government review agencies would continue to have limited manpower and capacity in spite of an expanding coal market. This limited capacity results in an increased permit and bond request backlog and inevitable delays in processing the requests. This scenario is a likely possibility if the government fails to streamline the permit and bond review process or continues to limit the review agency's manpower and capacity during a period of increasing demand for coal. Under the assumption that government agencies have limited manpower and capacity, the processing times are likely to increase in the event the demand continuously rises. In order to simulate this effect, we have steadily increased the permit review process from one year to two years and the bond review process from one month to six months. Both delays increase steadily over a ten year period for the purposes of graphics clarity only. None of the assumptions are predictions or forecasts, especially in regards to the timing of events.

In order to simulate behavior under increasing demand condition, we have increased the demand for coal five percent per year [4]. Based on trends in the seventies, increases in operating expenses and equipment costs were also made over a twenty year period. The trend in expenses was dependent on a desire to simulate the effect of government regulation on the marginal small operator. In this case marginal translates into approximately a ten percent profit margin. As demand pulls price upward, the operating expenses increase accordingly to maintain

this margin. The model was run to see if the small operator is able to bear the cost of bond payments in an expanding coal market. Processing times for reviewing a permit and a bond were kept constant at twelve and one month respectively. The state bonding fee was increased to $4,000 per acre (the current bonding fee in Pennsylvania) and bond retirement remaining at five year.

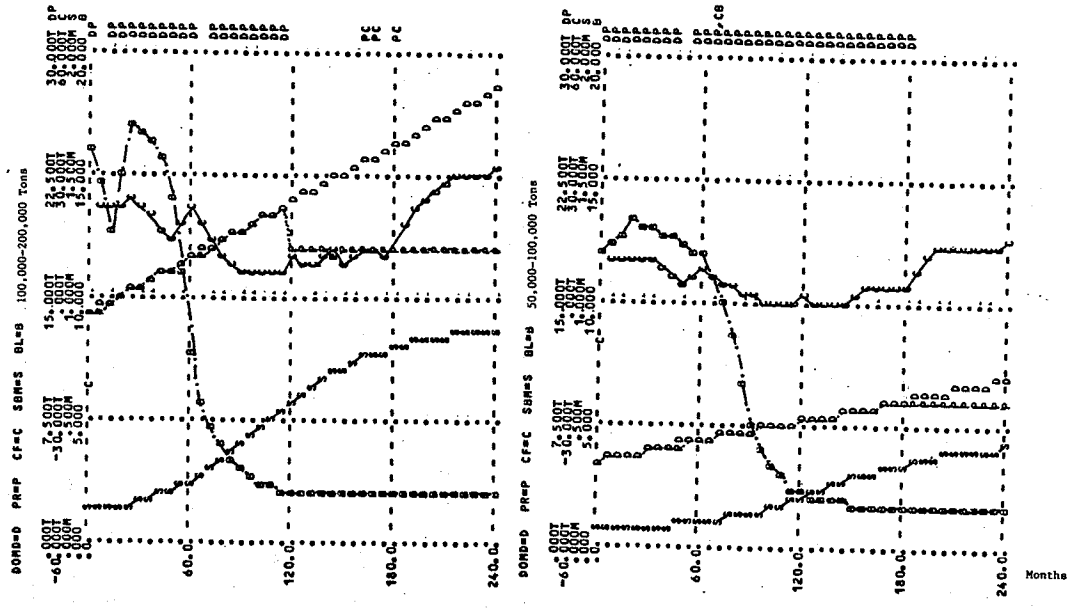
Under this scenario, the dynamic behavior of the small coal operator system proves to be undesirable (as expected). The bond payment rate is forced to increase rapidly in order to sustain desired rates of production. The increased bond payment rate depresses cash flow to a critical level. At this point, the small operators must back off the rate at which bonded land is being acquired to replenish cash flows. This action allows stocks of bonded land to fall to a level whereby stripping rates and subsequently production rates are also forced downward. When cash flows recover, the bond payment rate begins another increase in order to increase production to meet demand. As can be seen from the Figure 3, the large increase in bond payments and fluctuations in cash flows and production are harmful to an operator with a small resource base.

One solution suggested to alleviate the financial burden being carried by the small coal operator is to decrease the state bonding fee. State bonding fee of $4,000 per acre will be reduced to $1,000 per acre to determine if decreasing the fee will improve the previously observed behavior. The system appears to show some improvement. Observing Figure 4 reveals



Legend D: Demand, P: Production, C: Cash Flow,
S: Secured Bond Money, B: Bonded Land

Figure 3. Increasing Demand, Increasing Government Delays,
Bond Payment of $4,000/Acre and Bond Retirement at 60 Months



Legend D: Demand, P: Production, C: Cash Flow,
S: Secured Bond Money, B: Bonded Land

Figure 4. Reduction in Bond Payment to $1,000/Acre

that a reduced bonding fee allows the operator to remain operating, albeit, in a somewhat tenuous manner. Production does not seem to keep up with demand. Larger small operator seems to show much better performance compared to performance shown by smaller operator.

Another policy often considered desirable by bonding companies, banking institutions and the surface mining industry is reducing the length of time bond money is secured. The current length of time to retire a bond is five years. With a $4,000 per acre bonding fee, the quantity of money secured at any given time is considerable. An increased bond retirement rate was formulated by decreasing the time to retire a bond from sixty months to thirty months. The bond payment was left at $4,000 per acre. Figure 5 exhibits behavior of unstable cash flow. The smaller operator is struggling to remain in business despite a quicker bond reimbursement. Performance behavior of larger small operator is similar to exhibited under previous policy formulation of reducing bond fee.

In last policy formulation, the bonding fee was left at $4,000 per acre and bond retirement at five years. However, government permitting processing and bonding delays were kept at 1980 levels. That one year for the permit review process and one month for the bond review process. Figure 6 illustrates that the small operator systems exhibit a well managed behavior in the face of increased state bonding fees and rising demand.

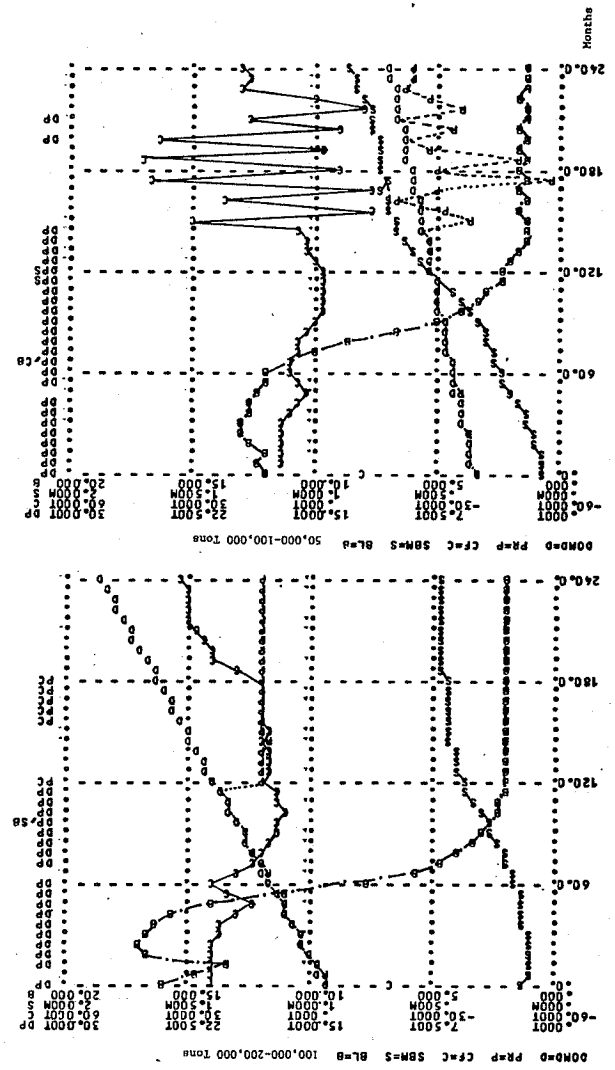


Figure 5. Early Bond Retirement at 30 Months

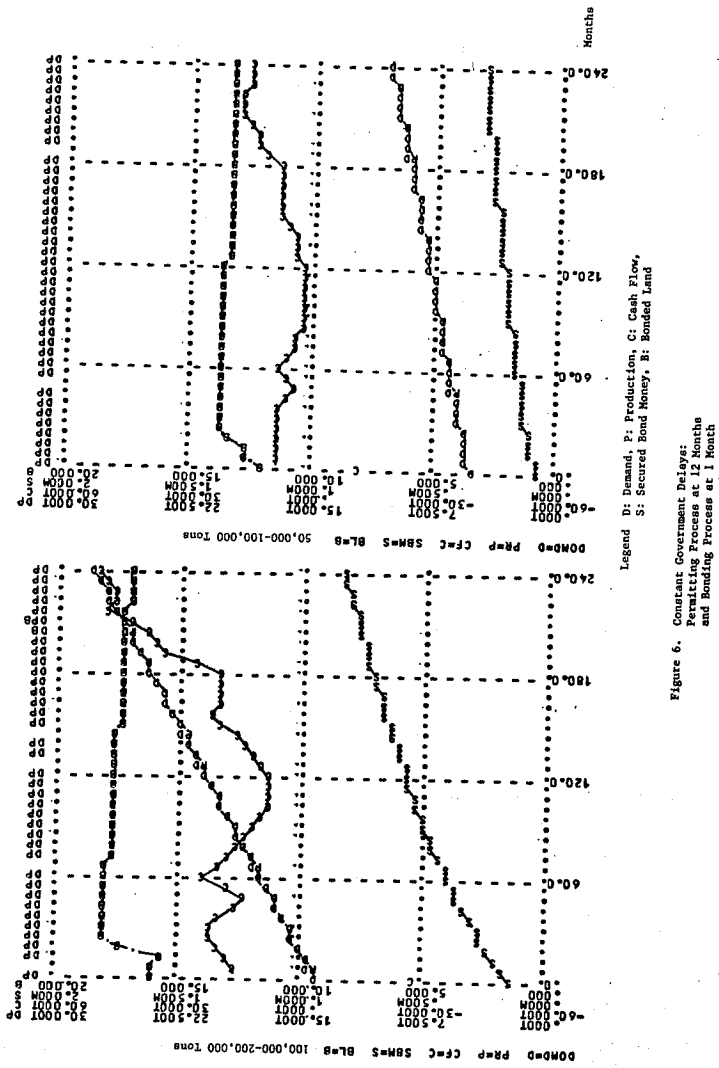


Figure 6. Constant Government Delays:
Permitting Process at 12 Months
and Bonding Process at 1 Month

Production is able to keep up with the demand and cash flows remain positive. Emergence of nonconfirming behavior can be seen, though, in the level of bonded land. Even with the permitting and bonding process times remaining constant in this run, pressures are still created when demand increases. The small operator does not respond very quickly to the pressures to increase the level of bonded land because of sensitive cash flows. The stock or inventory of bonded land does indeed perform its function of insulating the rest of the system from changes in demand. But given the fact that the small operator has sensitive cash flows and a small resource base, how much pressure can the stock of bonded land relieve, before its behavior is transmitted to and amplified in other areas of the system?

CONCLUSION

This paper described a system dynamic model and its use in understanding the impact of government processing delays on small surface coal operators. The model captures the physical and regulatory dynamics of land transformation within the surface mining cycle.

It was found that policies frequently considered by the surface coal mining industry and the government to alleviate the financial burden of small coal operators are mechanisms for channeling money to the operator in an effort to offset increased bond payment rates. By formulating policies that merely channel money to the small operator, financial pressures are controlled but not relieved. These types of policies addressed the symptoms

of increased processing delays, not the causes. Under an increasing demand scenario, reducing the permitting and bonding process delays is the key to improving the behavior of all small operators. More research into the structure and procedures of various mining regulatory agencies is needed to detail how and where suggested policies could be implemented.

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