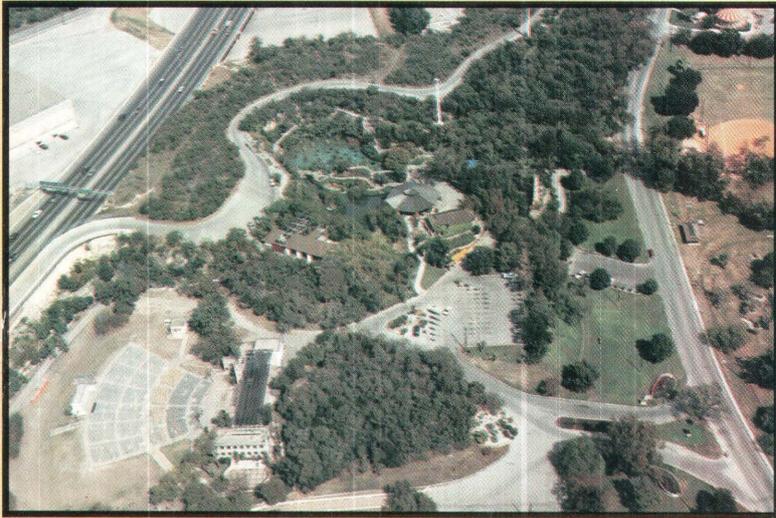


Industrial Minerals of the Midcontinent

Proceedings of the Midcontinent Industrial Minerals Workshop

*Prepared in cooperation with the U.S. Bureau of
Mines, the Arkansas Geological Commission, the
Illinois State Geological Survey, the Kansas
Geological Survey, the Kentucky Geological Survey,
the Missouri Division of Geology and Land Survey,
the Nebraska Division of Conservation and Survey,
and the Oklahoma Geological Survey*



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Cover.—Front cover (all front cover photographs courtesy of Mitch Leutger, Aero Views by Mitch, Macdona, Texas). Top: Aerial view of Breckenridge Park, San Antonio, Texas, showing Japanese Tea Garden, in center of view, situated in old limestone quarry. Left center: Aerial view of Alamo Cement Company quarry, San Antonio, Texas, during operation and early stages of reclamation and development of the Quarry Golf Course. Right center: Aerial view of Quarry Golf Course, San Antonio, Texas, as developed at reclaimed Alamo Cement Company quarry site. Left bottom: Aerial view of Redland gravel pit (outline), Fiesta, Texas, before reclamation and development of Fiesta Texas Theme Park. Right bottom: Aerial view of Fiesta Texas Theme Park, after reclamation and development of Redland gravel pit. Back cover: Japanese Tea Garden in Breckenridge Park, San Antonio, Texas, situated in abandoned limestone quarry. Photograph courtesy of the Department of Parks and Recreation, San Antonio, Texas.

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Edited and compiled by Alfred L. Bush and Timothy S. Hayes

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Presentations and discussions at a Workshop, September 16 and 17, 1991, in St. Louis, Missouri, held to probe the issues and options that impact the current situation in the field of industrial minerals, the availability, needs, problems, and plans for resources in the central midcontinent region of the United States

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ABBREVIATIONS AND ACRONYMS USED IN THIS REPORT

AAAS	American Association for the Advancement of Science
AASG	Association of American State Geologists
AGI	American Geological Institute
AIPG	American Institute of Professional Geologists
APA	American Planning Association
ARC-INFO	A spatial graphic data base system for manipulating geologic, topographic, demographic, and other information
ATV	All-terrain vehicle
B.S.	Bachelor of Science
CFC	Chlorinated fluorocarbons
CUSMAP	Continental United States Mapping Program
DALS	Department of Agriculture and Land Stewardship [Iowa]
DCCA	Department of Commerce and Community Affairs [Illinois]
DDT	Dichlorodiphenyltrichloroethane
DEQ	Division of Environmental Quality [Missouri]
EDF	Environmental Defense Foundation
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FGD	Fluid gas desulfurization
FHA	Federal Highway Administration
FOB	Free-on-board (cost to buyer, on carrier, at point of origin)
GIS	Geographic Information System
GNP	Gross National Product
GSB	Geological Survey Bureau [Iowa]
IAAP	Illinois Association of Aggregate Producers
IAC	Iowa Administrative Code
IANR	Institute of Agriculture and Natural Resources [Nebraska]
IDEM	Indiana Department of Environmental Management
IDMM	Illinois Department of Mines and Minerals
IDNR	Iowa Department of Natural Resources
IDOT	Illinois Department of Transportation
IEPA	Illinois Environmental Protection Agency
IHS	Interstate Highway System
ISGS	Illinois State Geological Survey
ISTEA	Intermodal Surface Transportation Efficiency Act
KAPA-KRMCA	Kansas Aggregate Producers Association–Kansas Ready-Mix Concrete Association
LUST	Leaking Underground Storage Tank program
MDIR	Minerals Directory [Kansas]
M.S.	Master of Science
MSHA	Mine Safety and Health Administration
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NGM	National Geologic Mapping program
NHS	National Highway System
NIMBY	“Not In My Backyard”
NIPC	Northeastern Illinois Planning Commission

NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NSA	National Stone Association
NSTA	National Science Teachers Association
OAC	Oklahoma Administrative Code
OMB	Office of Management and Budget
PBS	Public Broadcasting System
PR	Public relations
R & D	Research and development
RCRA	Resource Conservation Recovery Act
SCS	Soil Conservation Service
SEG	Society of Economic Geologists
SEMCOG	Southeast Michigan Council of Governments
SIMAPC	Southwestern Illinois Metropolitan Regional Planning Commission
SMAC	State Mapping Advisory Committee [Illinois]
SMCRA	Surface Mining Control and Reclamation Act [Missouri]
SMARRA	State Mining and Reclamation and Resources Protection Act [California]
SME	Society for Mining, Metallurgy, and Exploration
USBM	U.S. Bureau of Mines
USGS	U.S. Geological Survey
WGA	Western Governors Association

Industrial Minerals of the Midcontinent—Proceedings of the Midcontinent Industrial Minerals Workshop

Alfred L. Bush *and* Timothy S. Hayes, *Coordinators and Editors*

ABSTRACT

The Midcontinent Industrial Minerals Workshop, in St. Louis, Missouri, September 16–17, 1991, was the fourth U.S. Geological Survey-sponsored meeting on the essential role of industrial rocks and minerals in the Nation's social and economic framework. The meeting was organized, supported, and the agenda was determined by a group from the USGS, the U.S. Bureau of Mines, and the State geological surveys of Arkansas, Illinois, Kansas, Kentucky, Missouri, Nebraska, and Oklahoma, with early assistance in planning from the Iowa and Tennessee surveys. As the major industrial rocks and minerals used in the nine-State area of the Midcontinent are construction materials, the Workshop focused on sand and gravel and limestone-dolomite resources and the extraction industry for those materials. Because active audience participation was considered vital, representatives from industry, universities, geological surveys, planning groups, regulatory agencies, and State legislatures were invited. The audience consisted of 87 attendees out of 120 invited participants (no legislators attended).

The most important conclusions reached by the Workshop were that a need exists (1) to increase public awareness of the essential role of industrial minerals and (2) to educate land planners and others who make land-use decisions about the direct influence of their decisions on mineral resources. The theme of educating the public, starting with children and their teachers, was the subject of the keynote address by Dr. C.G. Groat, "If only Dick and Jane had gone to the mines."

Four major issues were discussed by five panels, each with a panel leader and three or four panel members. Wide participation in the discussion followed each panel presentation, some quite spirited. Final sessions summed the presentations and discussions, options for response to each issue were discussed, and numerous recommendations were adopted.

In the area of resource evaluation, the need for mapping is paramount; geologic, topographic, and many types of demographic data need to be acquired, preserved, and made available for selective collation. The Workshop fully supported the National Geologic Mapping Act (enacted a few

months after the meeting) and recommended the establishment of State mapping advisory boards to prioritize State needs and projects and also to consult with the Federal agency advisory board for the same purposes at the national level. The Workshop also recommended the universal use of data base systems to handle the collected information, specifically the broad use of Geographic Information Systems (GIS) techniques.

Land-use planning is an issue area that directly impacts the availability of construction materials. Undirected urban growth (urban sprawl) can overrun sites of mineral resources and prevent their future use. Planning must be based on adequate information, and planners need the assistance of those qualified to evaluate both what information is needed and how to apply it. The Workshop recommended that resource specialists and construction industry representatives take the initiative in working with the planners, providing early cooperation in planning rather than simply reactive assistance; the mineral resource community has to convince the planning community to view these resources as worthy of protection and preservation for future use. Planning must consider both present-day and long-range usage, but long-range uses should not be predicated on present-day trends, for the world of 50 years from now may have quite different needs and concerns. The Workshop recommended that planners adopt the principle of sequential, beneficial land use, recognizing, for example, that mineral extraction is a temporary land use, and that the sites will be available for other uses later.

Costs are a major concern of the industry. Regulations governing the permits to operate, and legislative actions with unforeseen consequences can easily drive up operating costs. Zoning and other planning decisions can result in major increases in the distance between quarry and user, with transportation costs becoming two or three times the cost of materials at the quarry. Changes in specifications for aggregate can result in increased production of "fines" for which the market is very restricted. No panacea for these problems is in sight, but the Workshop recommended increased emphasis on educating planners and legislators to the problems that their actions may cause, and on increased

efforts in research and development to identify new uses and create new products.

The relation of the industry to the environment is very much a major concern—how to produce construction materials in an environmentally responsive and responsible manner. What is environmentally responsible depends to a great degree on the viewer, and so the industry must contend with trying to reconcile the viewpoints of the planner, the public, the environmentalist, and the legislator. The options and recommendations are to participate in the drafting of permitting and operating regulations and in informing and educating the public and the legislators, to preplan to mitigate or avoid damage to the visual environment and the surface and ground waters, to abate dust and noise and other pollution, and to develop and publicize plans for reclamation. The basic principle, recommended by the Workshop and previously mentioned, is to adopt and implement sequential, beneficial land use. The industry's trade associations should advise, and, where feasible, assist the individual operators in how to comply with environmental regulations, and should support research and development efforts.

INTRODUCTION

This volume of the proceedings of the Midcontinent Industrial Minerals Workshop reports on the fourth of a series of meetings, held in the western and central parts of the United States, to investigate the status of the little-publicized but essential role played by industrial minerals in the economic and social framework of the United States. The first meeting was held in Tucson, Ariz., in 1988 (reported on in U.S. Geological Survey Bulletin 1905), the second in Los Angeles, Calif., in 1989 (USGS Bulletin 1958), and the third in Salt Lake City, Utah, in 1990 (USGS Bulletin 2013). The Midcontinent Industrial Minerals Workshop convened for 2 days in mid-September 1991 in St. Louis, Mo. The meeting was sponsored by the U.S. Geological Survey, with the cooperation of the U.S. Bureau of Mines and the active support and collaboration of the geological surveys of Arkansas, Illinois, Kansas, Kentucky, Missouri, Nebraska, and Oklahoma. Because of budgetary restrictions, the geological surveys of Iowa and Tennessee were able to participate to only a limited degree in the early planning, and were able to participate only unofficially in the Workshop sessions.

The composition, focus, and agenda for the Workshop were determined by a working group made up of representatives from each of the State and Federal agencies. Early on, the desirability of audience participation was recognized and emphasized, and so the group came to the consensus that the meeting should consist of invited participants, knowledgeable and experienced in dealing with industrial minerals. A maximum of about 120 attendees was set, allowing for 15 participants from each of the seven States, and 5 each from the Federal agencies (Geological Survey, Bureau of Mines,

Environmental Protection Agency). With the inevitable attrition of late cancellations, the meeting attendance totaled 87.

It was clear from the outset that the problems that beset the field of industrial minerals are pervasive throughout the Midcontinent, although expressed in a multitude of local situations, and so the program was designed to approach regional and local aspects.

Four major issue areas were selected for discussion: (1) resource evaluation; (2) land-use planning; (3) economics of industrial rocks and minerals used in construction, and (4) environmental issues in resource availability. For these issues, five panel discussions were planned, with major points of view to be presented to the audience by panel members. Panel leaders were selected by the working group, and the leaders, in turn, selected three or four panel members.

The Federal Highway Administration was requested to participate in the meeting because the single largest consumer of industrial rocks in the Midcontinent, both in volume and value, is the surface transportation industry. Dr. Anthony R. Kane, Associate Administrator for Program Development, delivered the "kickoff" speech that set the tone for the Workshop. As the Table of Contents indicates, talks on the four issue areas and an overview of the industry followed. Over the next day and a half, panel discussions continued, beginning with the issues of information essential to resource availability and following with the issue of land-use planning. The importance of public education toward the acceptance of rock and mineral extraction had been recognized at the start of planning for the Workshop, and so Dr. Charles G. Groat, Executive Director of the American Geological Institute, was asked to deliver a keynote address on that subject. Panel presentations continued with discussions of financial cost factors in industrial minerals, of environmentally responsible production, and of the environmental costs of ignoring resource data. A final session summarized the presentations and discussions, and collated a list of "Issues and Options." Open discussion from the floor of all presentations was actively encouraged—but need not have been. The discussions were courteous, numerous, to the point, and at times verged on spirited (the compilers of this report have done a little editing).

All the proceedings and the keynote and banquet addresses were taped and transcribed. The following is a virtually verbatim transcript of those proceedings and addresses, with a minimum amount of editorial changes. We, the editors, have prepared the Abstract, the Introduction, and the Summary. We have attempted to summarize those issues and those options affecting Midcontinent constructional industrial minerals that were the consensus opinion of this Workshop. These were not unanimous among Workshop attendees. Also, in the Summary, we have, at places, used the words of one or another Workshop attendee without giving direct credit to the original author. We thank all the Workshop attendees for that editorial privilege. In that issues and options summarized were not the unanimous view of all the

attendees, the reader is advised to refer to the verbatim transcript of the Workshop proceedings below for more detail.

The views presented are those of the speakers, and do not reflect the official position of the U.S. Geological Survey.

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WELCOME

Monday morning, September 16, 1991

Timothy S. Hayes, U.S. Geological Survey

Good morning, and welcome to the Midcontinent Industrial Minerals Workshop. The Workshop is sponsored by the U.S. Geological Survey, with the help of the U.S. Bureau of Mines, and the active participation of seven Midcontinent geological surveys, the Arkansas Geologic Commission, the Illinois State Geological Survey, the Kansas Geological Survey, the Kentucky Geological Survey, the Missouri Division of Geology and Land Survey, the Nebraska Division of Conservation and Survey, and the Oklahoma Geological Survey. Our hosts are the Missouri Division of Geology and Land Survey.

Along with welcoming you, my job is to let you know that we have all come here to do a job. This is a Workshop and we have come together to address issues that affect the availability of industrial minerals for construction in the Midcontinent. Our purpose is to point out the critical need for industrial minerals for construction that has to be faced in the Midcontinent if the infrastructure is to grow or even just be maintained. We are tasked first with identifying the issues that affect industrial minerals availability and then with producing a list of options available in addressing those issues.

Each of the seven State geological surveys has contacted a number of individuals with experience in one of the following areas: industrial minerals production, industrial minerals trade associations, land-use planning, government agencies that provide industrial minerals information, government agencies that regulate the minerals industry, State or local legislative bodies, educational institutions, environmental organizations, and the press. You were each asked if you would be willing to participate in this kind of Workshop on the industrial minerals. We hope that everyone who came here came with full intent to participate and add to the pursuit of our goal of a list of issues and options on these subjects.

The Workshop is organized around four major identifiable issue areas: First, industrial minerals resource identification; second, land-use planning to ensure industrial minerals resource availability; third, economic limitations on industrial minerals resource availability; and fourth, environmental issues that affect production and consumption of the industrial minerals. This morning we will be listening to a series of formalized talks that present in turn an introduction to each of the four major issue areas. Each presentation will be given by an expert in that area. These presentations will follow a kickoff address by Dr. Anthony Kane of the Federal Highway Administration, that will, I am sure, illustrate the critical need for industrial minerals for construction in this region of the country. The presentations that introduce the issue areas will then be followed by a final presentation this morning that briefly presents a view of the state of the

industrial minerals producers in the Midcontinent. The Workshop is being recorded and will be transcribed, edited, and published as a U.S. Geological Survey bulletin.

The afternoon session is organized into five panel discussions in which we encourage everyone to participate. The panels are composed of individuals with specific experience in each of the four major areas—resource identification, land-use planning, economics of the minerals industry, and environmental issues affecting the minerals industry. Of course, selected as you were, we realize that everybody in this Workshop group has experience that would qualify them to serve on one or more of the panels. For that reason, we have charged the panel leaders with keeping formalized presentations this afternoon to a minimum, in order to be able to draw on the cumulative experience of this Workshop group. Again, we hope that you will make yourself heard in the panel discussions.

In addition to discussing the four major areas that form the core of the Workshop, we will have a fifth panel discussion on the environmental costs of ignoring resource data. That subject should be particularly stimulating.

This evening there will be a presentation by Dr. Charles G. “Chip” Groat of the American Geological Institute who will emphasize the need for education about the role of minerals in our society. He calls his talk “If only Dick and Jane had gone to the mines.”

The panel leaders and members have a particularly tough task at this Workshop. We have asked them all to meet to produce a summary of the discussions. Those summaries will be used to get a head start when we reopen each panel in turn. That will be followed by a session where any topic can be reopened for discussion. In the final half day of the Workshop, we have the job of trying to summarize what has been said over the previous day and a half. We hope to frame that summary as a list of issues that affect the availability of industrial minerals for construction in the Midcontinent and to match that list with a list of options on how those issues might be addressed. After that summation, we will reopen discussion for a final time and ask for everyone’s help in refining the lists of issues and options.

It should then take a little over 1 year to transcribe, edit, and publish the proceedings from today and tomorrow as a USGS bulletin. [Editors’ Note: If only it had been so!] Previous bulletins have been published for earlier Workshops held in Tempe, Arizona (1988), Marina del Rey, California (1989), and Salt Lake City, Utah (1990) on industrial minerals in Arizona, Southern California, and in the Great Basin States of Idaho, Nevada, and Utah. We hope that these bulletins will be a resource for everyone involved here, providing some recommendations and expert opinion on which policies and perhaps decisions can be based. In hoping that the product bulletin becomes an informational resource, we are also inviting the State geological surveys to add appendices which list sources of information about each State’s industrial minerals. We hope we can fill the pages of a

bulletin with some really substantive suggestions on how to ensure the availability of industrial minerals for construction in the Midcontinent and how to do so in an environmentally responsible way. Because USGS bulletins are distributed to earth science libraries worldwide, we may be able to have at least a little impact on industrial mineral extraction problems internationally as well as domestically.

The “kickoff” speaker for our Workshop is Dr. Tony Kane, the Associate Administrator for Program Development of the Federal Highway Administration. In this position he oversees the Highway Administration’s planning, environmental, land acquisition, engineering, construction, and Federal aid functions. He holds a B.S. in Civil Engineering from Rensselaer Polytechnic Institute, an M.S. in Transportation Planning from Northwestern University, and a Doctorate of Business Administration from George Washington University. Dr. Kane has in the past few years served as Director for Development of the National Transportation Policy for the Secretary of Transportation and directed a major agency-wide task force to assess the future of the Nation’s highways. In his career at the Highway Administration, which goes back to 1972, he has also served as Associate Administrator for Right-of-Way and Environment, Director of the Office of Policy Development, and Chief of the Transportation Studies Division. This morning we have asked Dr. Kane to share his views with us about the critical need for resources to rebuild and expand the infrastructure.

KICKOFF—THE HIGHWAY INFRASTRUCTURE AND INDUSTRIAL MINERALS

Dr. Anthony R. Kane, Associate Administrator for Program Development, Federal Highway Administration

Thank you. It is a pleasure to be here today. It is a critical time for infrastructure in this country, particularly for transit and highways, as at the Federal level, come September 30th, the 5-year funding program expires, and some of you may not know exactly what all the issues are. A lot of the news media have been playing the problem up over the last few years, and there is a lot of legislation pending right now on the Hill. [Editors’ Note: Three months after Dr. Kane’s talk [in December 1991], the highway and transit bill, entitled “The Intermodal Surface Transportation Efficiency Act of 1991,” was signed into law. The Act, which covers the period 1992–1997 inclusive, provides \$140 billion from the highway and transit accounts of the Highway Trust Fund (a 6-year period) plus \$15 billion in general funds. There is a reduction in the fuel tax of 2.5 cents per gallon, which supports deficit reduction, beginning in October 1995.]

What I thought I would try to do is give an overview of where we are today with regard particularly to highway

infrastructure in this country, and a summary of a recent report to Congress that talks about the condition and status of the Nation's highways. Then I want to indicate where we are on the Hill, where the House is, where the Senate is, and what I expect to happen. My own prognostication is probably going to be wrong; forecasts, in general, about what Congress might do always tend to be wrong. Then, I want to touch on a few implications with regard to the group that is here today, the impact of investment in highway infrastructure and what that means for all the concerns that you have, with regard to your own particular industry.

I was really impressed at the similarities in a lot of what we do. If you just looked at the main categories of topics this Workshop is going to focus on, namely, the demand for resources, land-use issues, economics and environment, I would have thought I was in a transportation conference. These are exactly the same kinds of main themes that we focus on at all of the highway infrastructure and transit infrastructure conferences. Clearly we are forced to face the same kinds of challenges. You are the materials suppliers for infrastructure across the board, whether it is in building construction, transit, highways, etc. You have to address so many of the same issues but perhaps in a different fashion.

What I would like to do now is focus on the condition and status of the Nation's highways, a little bit on where we are heading on legislation, and then come back and close with some comments with regard to the industry itself.

First, let's look at the pavement condition in this country. On the collector roadways, which are the roadways that are a step up from the local neighborhood roads and streets, about 60 percent of the pavement is in poor or near-poor condition. These terms describe ranges according to a pavement serviceability rating; below a certain level, we give it an indication of poor or near-poor. The interstate system has about 25 percent of its miles in these two categories. What has happened over the last 10 or 20 years (particularly the last 15 years) has been an increased level of investment by the Federal, State, and local governments in pavements. Whether you have observed it in your own particular neighborhood or in your own particular State, from a national perspective (using the data sample that we have of all roads in this country) those conditions have stabilized. We have tended over the last half a dozen years to keep pace. In other words, things are not really getting worse with regard to pavement conditions. The miles designated interstate arterials and collectors represent about 1.2 million miles out of close to 4 million miles of road in the country. Most of the miles are local roads and streets, neighborhood roads and streets, land access roads. But of those 1.2 million miles of interstate arterials and collectors, half of those roads are in poor or near-poor condition. To keep a steady pace takes an investment in about 100,000 miles of roads a year in both rehabilitation of the pavement and major reconstruction of the pavement. Obviously, a demand is there for aggregates and for minerals for the repaving process. I think one message is

that after a lot of newspaper media play, of VCR films that were sent to local Chambers of Commerce, and so forth, we have come to acknowledge the problem, and there has been an increased level of investment on the pavement side.

Next consider the deficient bridges in this country. There are close to 600,000 bridges in the United States and we have an inventory of all of them. Information must be submitted by all the States on the condition and status of all of the Nation's bridges. This requirement was imposed by Congress many years ago, so we have a pretty good idea of where we are with regard to bridges. The numbers show that about 226,000 bridges of the Nation's 577,000 bridges are deficient, either because of structural load-carrying capacity or functionally, meaning they are just no longer designed for the traffic that they need to serve at the present time. While the 15,000 problem bridges on the interstate system (4,000 structurally inadequate, 11,000 functionally inadequate) are a small number compared to the total, that is only today's condition. If you forecast the future, as we did, for the next 25 years, we estimate that 35 percent of the Nation's investment requirements for bridges are going to be in the interstate system. The reason is that they are kind of the baby boomer problem. They came on late in the process. But they are also very large structures, lots of square footage of bridge area, and when you forecast to the turn of the century, that's where the real problem is going to be in terms of the bridge program. Today you hear about the little local bridges, and you hear about the two-lane bridges that have to be shut down and about the school buses that can't go across them. But in terms of real dollars, the impact is going to be on the higher level bridges in this country.

The real problem and the real message in highways is congestion and the degree to which it has been getting worse. Every 2 years we have to send a report to Congress on the status of the Nation's roads and bridges. We just did that in July '91. For the interstate system we show that the peak hour volume-to-capacity measure of how much the roads can handle (traffic demand versus what the roads theoretically are able to carry) is getting worse. Well, when the measure reaches a level of 0.95, you are really in a break-down condition. And 51 percent of the interstate miles in urban areas are in that state right now. Other arterials are at the 30 percent level, with an 11 percent level for collector roads. If you take a look, however, at the growth trend, while I mentioned that things have stabilized in the pavement area over the last 6, 8, 10 years, in the congestion area that is not at all the case. In fact, on the interstate system, in just the last 6-year period, there has been a 30 percent increase in the amount of traffic that is in a congested state. So we are continually tending to get worse with regard to congestion in this country.

The implications of that, as I get into the investment requirements, are very significant, because we took a look at what you theoretically could try to accomplish in metropolitan areas through very aggressive campaigns to shift people to other modes of transit, to increase auto vehicle occupancy,

to get people riding in more high occupancy vehicles. And even with that it translates to a very, very significant increase of lane miles of highways to try and meet the demands that are out there. If built, those lane miles of highways clearly translate into a significant investment, significant, ergo, a need for materials.

Focus again just on the interstate system, because it's that road system that is 1 percent of the miles in the country but handles over 20 percent of the travel. In '85, 11 percent of the pavement was in poor condition, and in '89 we estimated it had dropped to about 10 percent. So there is progress on that score. At a slightly different level of congestion, where the measure of volume to capacity is over 0.8 (a very heavily congested as well as a starting-to-break-down level of congestion), in '85, 61 percent of the road miles fell in this category, in '89, it was 70 percent. Between 1983 and 1989 there was a 30 percent increase in that performance category. So clearly, congestion is a very high focus of where we have to go with regard to new options and new plans for the future.

Congress also asked us to take a look at what it would cost to do something about the infrastructure problem in this country. The numbers that we reported in July to the Congress, looking at the lower level, show that on all road systems the present level of investment is about \$33 billion a year in capital investments. This includes local roads and streets, where we estimated the investment that the private sector is making as well as the public sector in terms of new streets as part of subdivisions. That's not routine maintenance, it's not operating costs, etc.; it's the capital investment side of things. Thirty-three billion dollars, but that translates to 1.6 cents per vehicle mile of travel. In my mind it's a small number when you look at what it takes to own and operate an automobile, between 30 and 40 cents per vehicle mile of travel, after you take account of vehicle depreciation, insurance costs, fuel costs, etc. So it's a very small component when you look at it from that scale. We estimated two investment levels in the report to Congress: one, just to keep things where they are today, to attempt to not let congestion get worse and to attempt to not let pavement get worse. We estimated it would take about \$46 billion a year. And then we asked, what would it take to try to make things better? Assuming, as I said earlier, a very, very rigorous campaign to get more people into other modes of transit, into high occupancy vehicles, etc., we think a realistic estimate of investment comes to \$75 billion a year, or 3½ cents per vehicle mile of travel. When you compare that to what it takes to own and operate an automobile, that doesn't sound like much. We just need to get 2 cents a mile of travel out of everyone. Well, look at the tax instruments that you have to use to get money because most of the highways in this country are supported by dedicated user fees. If a typical car gets 20 miles per gallon, it would take a 20 cent per gallon gas tax to get 1 cent per vehicle mile of travel. So it would take a 40 cent tax to get those 2 cents per vehicle mile of travel. But look at the newspapers when a State highway

department tries to get a 1 cent or 2 cent or 3 cent State gas tax passed. Tough time, very tough time. So that is kind of the dilemma we are faced with. On the one hand I can sit here and say it's a pretty small number, all we need is another penny or two per vehicle mile of travel. But then translate that into the way you have to raise that money, which traditionally has been through gas taxes, and you get outcries from the public of not wanting an increased tax and you really get an inability, a lack of leadership on the part of politicians, State, local, and Federal, to make a commitment to say that we really need to do something about infrastructure, despite a possible drop in a few of the polls.

But what are we doing right now? I mentioned that the highway and transit programs are due to expire. And for the last several years, there has been a very, very significant effort across the country on the part of all interest groups, county officials, State officials, material suppliers, consultants, contractors, etc., to focus on where the highway program should go in the future. The interstate system is virtually complete. That was the dream, the vision; in the late fifties when Congress authorized the Federal aid highway program, it was to build that interstate system. And that's where the bulk of the money has been going. But we don't need that level of investment any more because the system is virtually complete. So, where might we head? Well, the administration has developed a proposal, the Senate has enacted a measure earlier this year, the House of Representatives is in real turmoil with regard to where to go. There is tremendous disagreement. The House Committee passed a bill out, but did not bring it to the floor, because as many of you may have seen in the paper just before the summer recess, the House of Representatives is going for a 5 cent national gas tax increase. And there was really not support for the Committee bill in the House. So Speaker Foley decided not to put that bill on the floor before recess, because he knows it probably would have failed, plus the President has come out extremely strongly, saying, "I will veto any new package that has an increased gas tax in it." So right now we sit with an administration bill that was submitted to the Hill (a 5-year program), a Senate bill that was passed, and a House bill that has only passed Committee—it hasn't gone to the floor. In fact, as we meet today, the leadership in the House is trying to make that strategic decision as to whether they go back to the Committee and rewrite their highway bill without a gas tax, or go to the floor and see if they have the votes, and see if they can carry it over the President's threat. [See Editors' Note, p. 4.]

Now as to the funding level: the total transit and highway money is about \$105 billion for the 5-year period by the administration's proposal, about \$124 billion in the Senate bill, and \$154 billion in the House of Representatives. Clearly there's a big difference between \$105 billion in the administration's proposal and \$154 billion in the House proposal. I should mention, however, that the administration proposal is over a 1/3 increase above where we are today.

So, even the administration's proposal is a significant increase in the level of construction expenditure in the highway area over the next 5 years. I think the message probably is that, assuming we ever get the House bill to a vote, if we ever get to a House-Senate conference, and if we ever get a bill enacted, there is going to be a significant, a very significant level of investment in highway construction. Translate that, then, into the industry that you deal with.

The administration has tried to consolidate the number of major programs that we have. Our program is about \$17 billion a year, and we wanted to try and put it in a smaller number of categories, so that State and local governments had more flexibility in how to use the funds. Well, the Senate didn't quite like that idea. They created a whole host of programs including interstate completion money. I mentioned the system is almost finished but it still requires a little bit of money to finish it. The Senate wanted to target some money for annual 3-R maintenance (rehabilitation, restoration, and resurfacing) investments in the interstate. They also created something called the surface transportation program—a very large block grant. In fact, most of the money is right there. Senator Moynihan from New York chaired the Senate Committee, and he very much wanted to give State and local governments the ability to use highway money for anything, any kind of rail improvement, any kind of transit improvement. He is very much moved by the environmental coalitions, by the Clean Air Act, and most of the Senate bill is very strongly driven by environmental consideration. And in that Senate bill is a very strong package of provisions that are very much environmentally driven. It has a congestion mitigation program—a special pot of money—to focus on those metropolitan areas that have clean air problems. It has a bridge program and a couple of programs that are merely mechanisms to distribute money, in some fair sense as defined by the Senate, to individual States. The House of Representatives bill had an even larger number of programs—national highway, urban mobility, rural mobility—a flexible category of funds that States could do what they want with—safety, bridge, and, again, a program to spread money out across the States as a function of where the Federal gas tax came in—a fairness kind of program.

Just a couple of points on funding levels. It takes between \$7 and \$8 billion over 5 years to finish the interstate system which is clearly almost finished. That's the total amount of money required to finish those last few gaps in the system in the country. Now we're very much interested in having something formally called The National Highway System, that is our vision for the future. It would be about 150,000 miles of arterials, the principal arterials in the country and in the interstate system. In the administration's bill, that's where we targeted our resources, to let that be the vision for the future. We need to upgrade the 100,000 miles of principal arterials that are off the interstate system and put the focus there. The Senate at least calls for designating such a system, but targeted a very small amount of money from

what's labeled as STP, their block grant—only about 17 percent. But they said in their bill that States could use all of it if they wanted to on national highway systems.

In order to get a bill enacted and signed by the President, there will have to be a new concept in Federal programs and it will be something called The National Highway System. It will focus and thrust on about 150,000 miles in this country, on the principal arterials in the country. In terms of the urban and rural program, there was about \$22 billion a year in the administration bill, our version of a block grant to the States to let them use as they saw fit for transit or for highways. The Senate had similar concepts; they just divided them into categories. I should highlight that for the bridge program there was about \$11 billion over 5 years in the administration's proposal, \$13.5 billion in the Senate, almost \$17 billion in the House. Those levels are starting to become a doubling of the level of investment in bridges that we have today. So, clearly, there would be a much larger investment in bridges from the Federal perspective. That matches our forecast of what things are going to be happening with regard to bridge conditions in this country; it's those larger bridges that were built in the sixties on the major roadways that are going to be the main problem as we hit the turn of the century.

I guess that's it on the legislation. Will we have a bill? Well, in 1987, we went through this same thing, the Congress wasn't trying any major restructuring of the highway program, and it still took 7 months to get the final bill. There was a real delay and not having those authorizations had pretty severe impact on the States. So there is the potential for a real impact on the States come October in the absence of new surface transportation legislation. Luckily, not a lot of construction bids are let in that part of the year, so the impact may be a little bit mitigated, but the amount of funds that are left over are very small compared to the annual level of programs. There will be a significant impact, and lots of interest groups from all the construction organizations are really trying to encourage Congress to get a new surface transportation bill enacted. Lots of pressure is coming from State departments of transportation, etc.

I asked my staff to focus on one aspect of your industry, the amount of aggregates that we use as a result of the Federal Aid Highway Program. We estimated that 214,000,000 tons of aggregates were used in the Federal Aid Program in 1990, and that under our construction proposal, which is far lower than either the House or Senate proposal, that number would jump to 350,000,000 tons by 1996. Under the House and Senate bills the numbers would be even larger than that. What are some of the other aspects on the aggregate side that have been happening recently? Well, one is a real big thrust towards enhanced quality construction, and that involves the whole spectrum from design to all of the materials used in construction, and to construction processes themselves. The American Association of State Highway and Transportation Officials just appointed a new task force on construction

quality. I think we will be seeing a much stronger focus on things like quality assurance, quality control, changes in the specifications that we have nationally in highway construction. Perhaps there will be changes in concepts on bonuses and contracting procedures, as well. In addition, there is one little area that has taken the attention of a number of the State highway departments. Last year, there was a fact-finding mission on the way pavements are constructed in Europe, where there is much greater focus on initial investment, on initial design, on initial materials, on thicknesses. One concept called stonemastic asphalt has created a lot of attention and we are testing it now in about six States. It puts stronger emphasis on enhanced quality aggregates and on polymer additives to the asphalt. It makes a stronger pavement structure, kind of a stone-on-stone composition. The Europeans are willing to spend a lot more money on transportation costs with regard to aggregates and will ship from greater distances than we tend to in the United States. Whether or not we are ever going to become long-sighted with our short-sighted pocketbook, I don't know. The same thing could be said and has been said about other aspects of American industry. Highways are not alone. People tend to say, "It's greener on the other side, in Japan they do it this way, in Germany they do it this way; people take a long-range look, they increase front-end costs, because in the long run, life-cycle costs are reduced." Whether that will happen to us, I don't know, because the tendency has always been to be very much short-range oriented with regard to what we do.

There's going to be a stronger focus on additives and new materials in construction. There are going to be some other things that the Department is doing which I think will impact your industry, and that is with regard to the transport costs. We're starting to put a much greater focus on how the various transportation modes (airports, railroads, highways) tie together. Port access, in particular, is one thing that we have a strong focus and review on right now. In addition, we are pushing for continued economic deregulation in the transportation industry, albeit it affects interstate carriers more, whereas most of your industries are affected by intrastate carriers. We are also pushing for a lot of "uniformity" measures that we hope will eliminate the paperwork burden on the mode of carriers, which translates directly into costs. We have that built into the surface transportation legislation; hopefully, it will be enacted.

Overall, I see a much enhanced highway program in the future. I see that demands on the highway program are not dissimilar from the demands that you have with regard to very strong land use considerations, urban planning considerations, environmental protection considerations. In fact, most of the highway programs in metropolitan areas are going to be much more strongly driven by environmental constraints as we go out in time. Clearly, the House has that message. The environmental groups are very strong. They have been lobbying very effectively in the Congress. The kinds of language that are in both the House and Senate bills

for future highway programs mean there's going to have to be a much more conscious consideration of the environment, with planning requirements built into the legislation for enabling State and local governments to use planning money.

Thank you. It has been a pleasure. Have a good conference.

Timothy S. Hayes:

Thank you, Dr. Kane. That certainly does show a need for the industrial minerals for construction. Dr. Kane is not going to be with us all day, so I'll make an exception and accept a couple of questions. If we can limit them to just a few minutes, we'll entertain those questions. Does anybody have anything?

DISCUSSION

Dr. Charles J. Mankin, Director of the Oklahoma Geological Survey:

In one of the things that you talked about in your planning, it wasn't clear to me whether you had included changes in the cost of transportation fuel in the projected growth of use of highway systems. The United States, of course, has the cheapest transportation fuel in the world, that's based on the fact that world oil prices are at an almost all-time low in modern history. In 10 years, most of us believe world oil prices will probably double. That's going to have a significant impact on transportation fuel costs in the United States. Has that been taken into consideration in the growth and the use of the highway system?

Dr. Anthony R. Kane:

The answer is "yes." Whether it was taken into account adequately, correctly, in the minds of everyone is another question, for sure. We recently, in 1990, developed the National Transportation Policy. It focused on a number of issues, including energy aspects and transportation. Along with that, we developed a much more comprehensive analytical report called "A Strategic Look at Transportation" and submitted that to the Congress, as well. We focused on those increasing energy costs, and tried to utilize the consensus forecast from the Department of Energy and forecasts from various other economic groups, tried to see what the effect would be in the highway demand area, tried to factor that in with some of the demand models that we had, to see what might be happening. At the same time, we estimated what might happen with fuel efficiencies, with alternative fuels, with the whole movement in that direction, as well. That, too, was put into the equation on highway demand and we

estimated what might be the effect on the transit side, etc. Even taking all that into account, we had pretty significant increased levels of demand on the highway side. A much stronger consideration was the demographic changes, and so as part of our 30-year forecast, we were looking at where we are today in terms of an almost 4 percent annual growth rate in vehicle miles of travel and came up with estimates for the future of 3, 2, 1 percent, and close to flat projections out to the turn of the century. We tried to consider all those things, but whether we adequately did or not, you know, is another question.

John A. Taylor, Oklahoma Mining Commission:

I'm a little puzzled on the relation of that 1.6 cents to 2 cents per vehicle mile of travel allocation for the funding.

Dr. Anthony R. Kane:

Let me restate and see if it's any clearer. I said that typical real costs of owning and operating an automobile today are close to 30 to 40 cents per vehicle mile of travel. That's the cost of your depreciation, oil, fuel, user fees, etc. That's what it really costs you. If you take the total level of investment that private, State, local, and Federal government have as capital investment in highway transportation, just rack up that total number that's being spent today and divide it by the total vehicle miles of travel that are out there, it only equals 1.6 cents per vehicle mile of travel. So that is the level of investment that's being made in highways right now. It's not allocated anywhere, it's not a single expenditure; that 1.6 cents is a collection of everything, it's fuel taxes, it's State registration fees, it's general funds. County governments' sources of transportation funds are from property taxes and general funds.

John A. Taylor, Oklahoma Mining Commission:

Let me put the question this way, in order to define it. The total investment needed versus the previous investment level of 1.6 or 2 cents should leave an allocable figure. What would that figure be?

Dr. Anthony R. Kane:

I would think, to meet all the needs that are out there, 3½ cents per vehicle mile of travel is about what you have to raise. The question is how do you raise that? In your words, how do you allocate the needed extra investment requirements? How do you get an extra 2 cents per vehicle mile of travel on average out of people? That's the real issue. Do you raise property taxes in counties? Do you put tolls on highways? Do you raise the gas tax? And what I tried to say was that, in terms of scale, to get an added average highway revenue income of 1 cent per vehicle mile of travel at 20 miles

per gallon would take a 20 cent gas tax. You don't have to have a 20 cent tax. You can raise property taxes and earmark it at the county level, you can raise the gas tax, you can raise registration fees, you can do a host of things. You can do as Maricopa County, Arizona, did and put in a ½ cent sales tax and dedicate it to highways. In Phoenix they are going to build 400 miles of new freeways, not from highway user fees at all, just from dedicated sales taxes.

ISSUE AREAS

Timothy S. Hayes:

I think we had better move on. Let's get directly to the subject of industrial minerals, starting with one issue at a time; let's begin with discussions of some of the issues that are recognizable in resource identification and evaluation. We have asked Dr. Morris Leighton, Brud Leighton, the Director of the Illinois State Geological Survey, to speak to us.

INDUSTRIAL MINERALS RESOURCE IDENTIFICATION AND EVALUATION¹

Dr. Morris W. Leighton, Director, Illinois State Geological Survey

My subject this morning is "Industrial Minerals Resource Evaluation." At issue is the economic availability of industrial minerals—nonmetallic, nonfuel minerals such as sand, gravel, crushed rock, and dimension stone. Specifically at issue is their availability for sustained growth envisioned for the construction of highways, roads, bridges, buildings, beach replenishment and even for shoreline defense structures (figs. 1 and 2). Why should availability of these materials be of concern? Aren't these materials available practically everywhere—readily available "off the shelf," so to speak? Are we worried about this? Can't we take it for granted? Let's briefly examine these questions.

In approaching these questions, forgive me if I use some examples from Illinois along the way—but by so doing I believe they are representative of conditions in other States, many other States, and, hopefully, they will fill in and help to broaden the perspective on this issue of economic availability of industrial minerals and the need for evaluation of these resources.

Let's look first at the question of demand. The increasing population of the United States and the continued reliance on highway and road transportation by that population

¹Remarks authored by Morris W. Leighton, J. James Eidel, James W. Baxter, and Subhash B. Bhagwat, all of the Illinois State Geological Survey.



Figure 1. Shoreline defense (groins), Lake Michigan, Chicago, Ill. Photograph from M.W. Leighton, from files of the Illinois State Geological Survey.

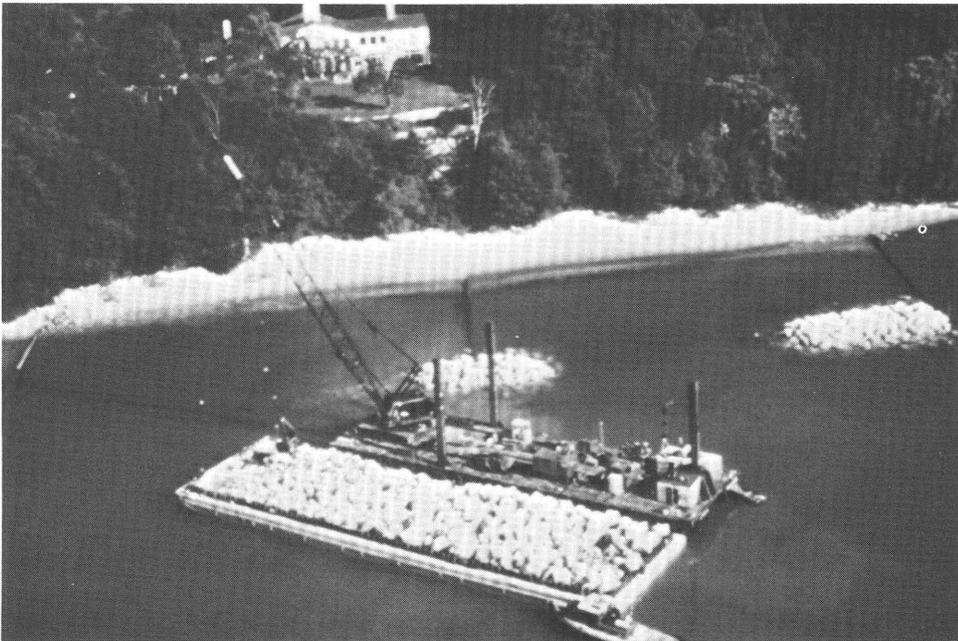


Figure 2. Riprap being placed for shoreline defense near the headwaters, Lake Michigan. Photograph from M.W. Leighton, from files of the Illinois State Geological Survey.

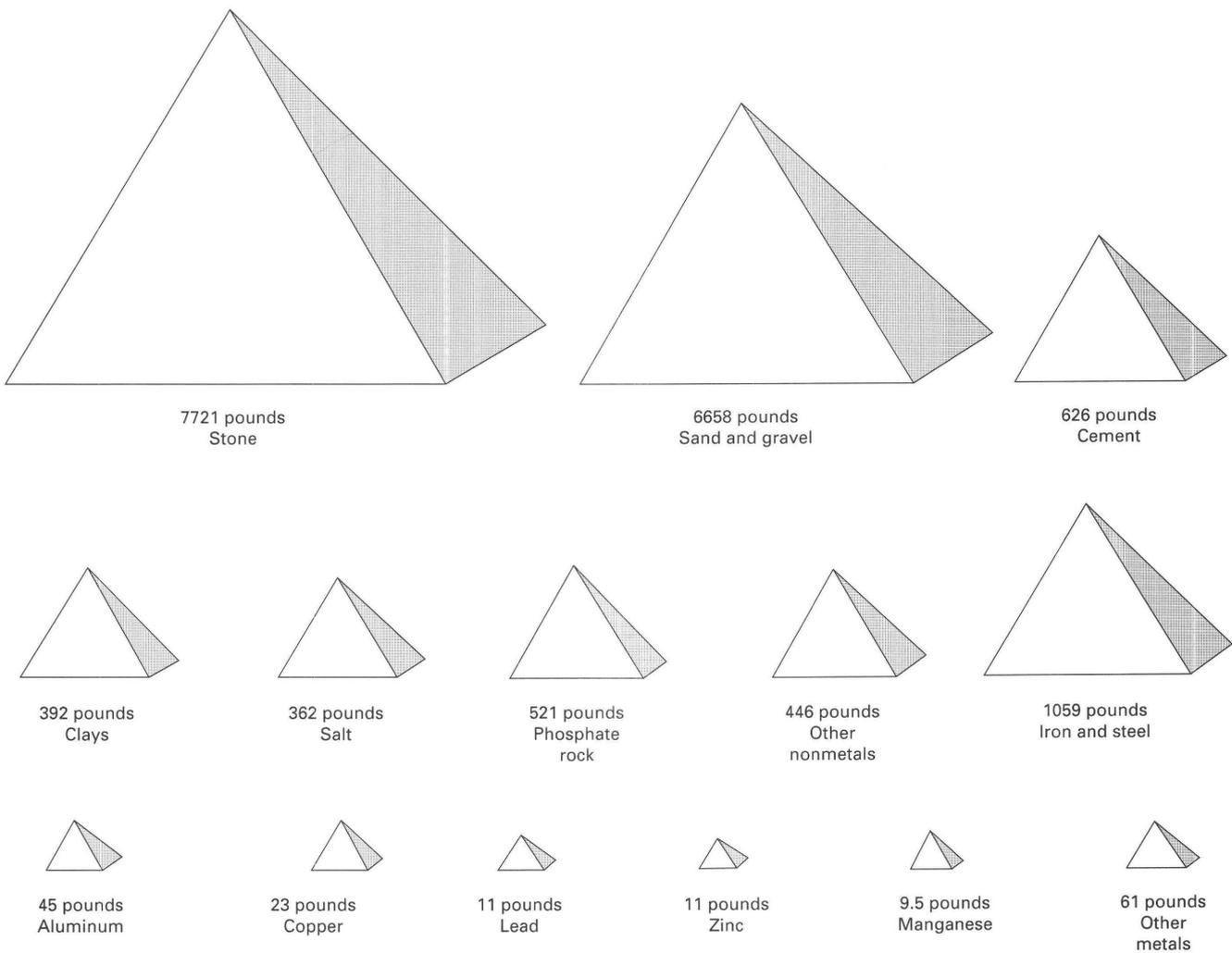


Figure 3. Annual U.S. per capita consumption (as of 1990) of nonfuel mineral materials (industrial rocks and minerals versus metallic products and metals).

virtually ensure an increasing demand for construction aggregate and sand and gravel for the purpose of expanding and rebuilding domestic infrastructure. On the average each U.S. citizen consumes on the order of 3¾ tons of aggregate, 3¼ tons of sand and gravel, ½ ton of steel, more than 500 pounds of cement, and almost 400 pounds of clay annually (fig. 3). The ability to construct and reconstruct the infrastructure depends on the continued availability, at a price the economy can bear, of sustainable resources of limestone, clay, and other materials used in the manufacture of Portland Cement and of crushed stone and sand and gravel resources for use in concrete construction and bituminous (blacktop) roads.

With respect to the building and rebuilding of the Nation's infrastructure, the U.S. Bureau of Mines estimates that: (1) over 40 percent of all bridges need repair or replacement; (2) much of the interstate highway system needs repairs, as do State and secondary highways and roads; and (3) half the schools in America are nearing 50 years in age.

The Bureau has further indicated that the U.S. lags significantly behind Japan, West Germany, France, the United Kingdom, Italy, and Canada in public works spending.

There are numerous Federal and State documents that contain estimates and plans for extensive future construction and rebuilding programs. In Illinois, for example, the Department of Commerce and Community Affairs (DCCA), prepared a Five-Year Plan in 1989 that estimated a need for a \$5.8 billion program to build and rebuild Illinois infrastructure over the next decade. The Illinois DCCA (1989) recommended keeping interstate highways in top condition, protecting Illinois' \$60 billion road and bridge system, developing key major highways, and improving congested urban and rural highways. The proposed program would: (1) rehabilitate 385 miles of roadway and 177 bridges on the interstate system; (2) resurface and widen 3,500 miles and rehabilitate 780 bridges on the non-interstate system; (3) develop key new economic principal arterials such as U.S. 51 South, U.S. 67, and Thorndale Avenue; (4) implement a

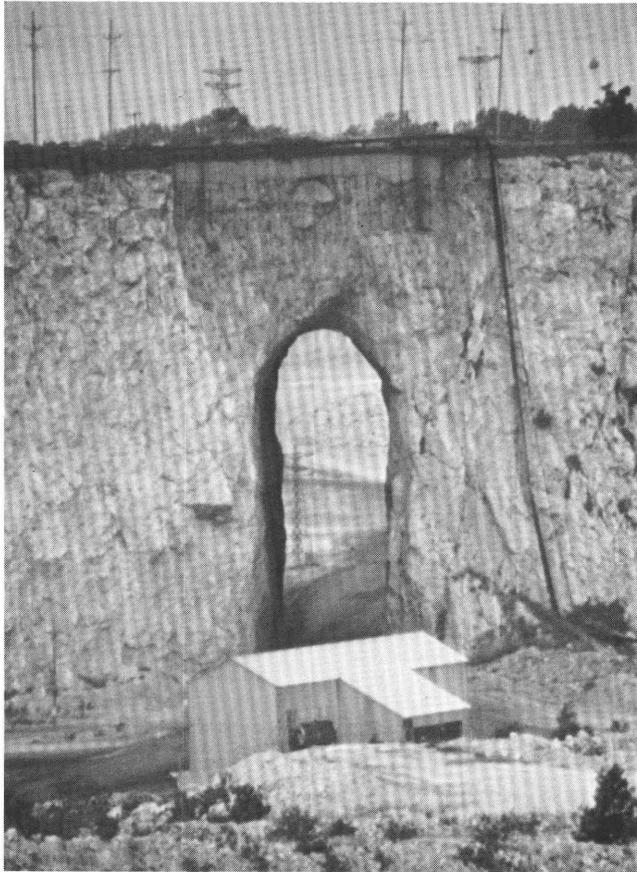


Figure 4. Thornton quarry in the Middle Silurian Racine Dolomite, Chicago area, Illinois. Photograph from M.W. Leighton, from files of the Illinois State Geological Survey.

concentrated program of road improvements; and (5) infuse \$525 million into local roads over the next 5 years.

In another example, a 1991 Office of Technology report listed rehabilitation and maintenance of the Federal surface transportation system as top priority for Federal legislation. The need for building and rebuilding the Nation's infrastructure is most apparent.

While there are many plans for and estimates of required new construction and repair, there appear to be no accompanying studies of the source of required resources of industrial minerals. The 1991 Office of Technology report, however, did note that "resources available for repair and preventive maintenance have been insufficient to maintain acceptable service levels on highways, bridges, and transit facilities across the country."

Few States and local agencies incorporate the availability of affordable resources in their planning. No mention is made as to whether adequate construction aggregates, or sands and gravels or water supplies exist to carry out the planned programs. Overall, we are not aware of agency efforts to determine the amount and source of the construction materials that will be required to meet the new and growing demands. The assumption appears to be that these

are items that can be obtained "off the shelf." Is this true? Are they readily available? We believe there is reason to be concerned. Let me illustrate.

In the Chicago area, the production of aggregate materials sufficient to meet requirements for modern construction is threatened as sites favorable for the extraction and processing of stone and sand and gravel become limited by urbanization. The area provides about 35 percent of the crushed stone produced in Illinois. The source is a high-purity, premium-quality Silurian dolomite, which occurs in a number of places at depths generally less than 50 feet below the land surface. The well-known Thornton quarry in the Silurian dolomite is an example (fig. 4). In some areas extensive deposits of sand and gravel overlie the bedrock surface. But urban sprawl has encircled most of the existing quarries and encroached on undeveloped resources, as well. This photo of the Thornton quarry (fig. 5) shows urbanization—residential encroachment from the north and northeast, a cemetery on the southwest—and quarry facilities on the southeast that overlie poor-quality source materials that limit development on the south and southeast.

Figure 6 shows the Bridgeport quarry, 1 mile from Lake Michigan with the Sears Tower in the background. This quarry, too, has been overrun by urban sprawl and has more recently been used for the disposal of urban waste. Figure 7 shows the limited potential for growth of another quarry in the Chicago area. Urban sprawl, depicted in this Skylab Photo of the Chicago area (fig. 8), has led to encroachment and forced abandonment of quarries, giving us pause to consider just where future resources will come from—especially resources at a reasonable cost.

Of the 20 major Chicago area quarries that have operated since 1970, 7 are closed or abandoned, 6 have been nearly depleted, 2 have resources that are limited by surrounding suburbs, and 1 has been converted to an underground mine as shown in figure 9. Only four quarries have adequate resources and room for expansion (but two of those are currently being contested).

The supply of industrial minerals for possible new uses also must be considered. For example, the Clean Air Act will require that 12.4 million tons of 2.8 percent sulfur coal, now burned annually without scrubbers by Illinois electric utilities, by the year 2000 will have to comply with the 1.2 pounds SO₂/million Btu standard. If this reduction in SO₂ emissions is to be achieved by using Flue Gas Desulfurization (FGD) technology, about 1 million tons/year of CaCO₃ (high purity limestone) would be required in addition to present production. How will these needs be met?

In addition to these needs for industrial minerals, information is required in other areas where economic growth may be limited by either the *apparent* absence of adequate supplies or by inadequate information.

So, what information is needed to fill in the gaps in our knowledge of the economic availability of industrial minerals and what information must be supplied to the planners to



Figure 5. The Thornton quarry, Chicago area, Illinois, looking north-northwest, showing encroachment of residential areas on the north and northeast, limitation by a cemetery to the southwest (barely seen), and siting of quarry facilities on poor-quality source materials to the south and southeast. Photograph from M.W. Leighton, from files of the Illinois State Geological Survey.

be incorporated in realistic development plans for the future? What is needed and where is it needed?

I contend we need to start with the location of economically available resources themselves. Where are they located? To do this, geologic mapping is required (fig. 10), especially mapping at an appropriate scale. Considering the need to integrate environmental considerations, permitting issues, and geology, detailed maps, compiled at the scale of 1 inch equals 2,000 feet (the common 7½ minute quad.), are required.

In the past, investigations of the distribution and potential use of industrial mineral commodities, including construction aggregate materials, have been carried out as an integral part by our Survey's program, as they have by many State geological surveys and by the USGS. For carbonate aggregate materials this has been accomplished through a combination of geological mapping of outcrops and outcrop areas, description and close-interval sampling of individual quarries and quarry ledges, sampling of outcrops that represent potential quarry sites, and detailed chemical analyses and physical testing to determine the potential best use of the

resources. These studies, for the most part, have been done on a county or regional basis, and generally at a scale smaller than 1:62,500 (1 inch equals approximately 1 mile).

While considerable regional assessment of industrial mineral resource availability has been conducted, we find that the most significant handicap in assessing the availability of industrial mineral resources is the lack of large-scale geologic maps suitable for the definition of drill targets and the estimation of resources. Geologic, chemical, and physical data presented at a scale of 1:24,000 (1 inch equals 2,000 feet) or larger are required to define targets and suggest drill sites for exploration projects. Such maps will tell us where to look to meet economic targets of given specifications. They may also tell us where *not* to look. For example, by reference to old site maps our Survey was recently able to inform a prospective producer that half of the assumed resource that he planned to purchase had been previously mined out.

Unfortunately, neither the U.S. Geological Survey nor most State geological surveys have sufficiently large programs committed to the timely acquisition of geologic data



Figure 6. Bridgeport quarry in the Middle Silurian Racine Dolomite, looking east with Sears Tower in background. Quarry, 1 mi from Lake Michigan, has been overrun by urban sprawl, and has been used for waste disposal. Photograph from M.W. Leighton, from files of the Illinois State Geological Survey.



Figure 7. Dolomite quarry in the Chicago, Ill., area, showing expansion of quarry constrained by urban development ("urban sprawl"). Photograph from M.W. Leighton, from files of the Illinois State Geological Survey.

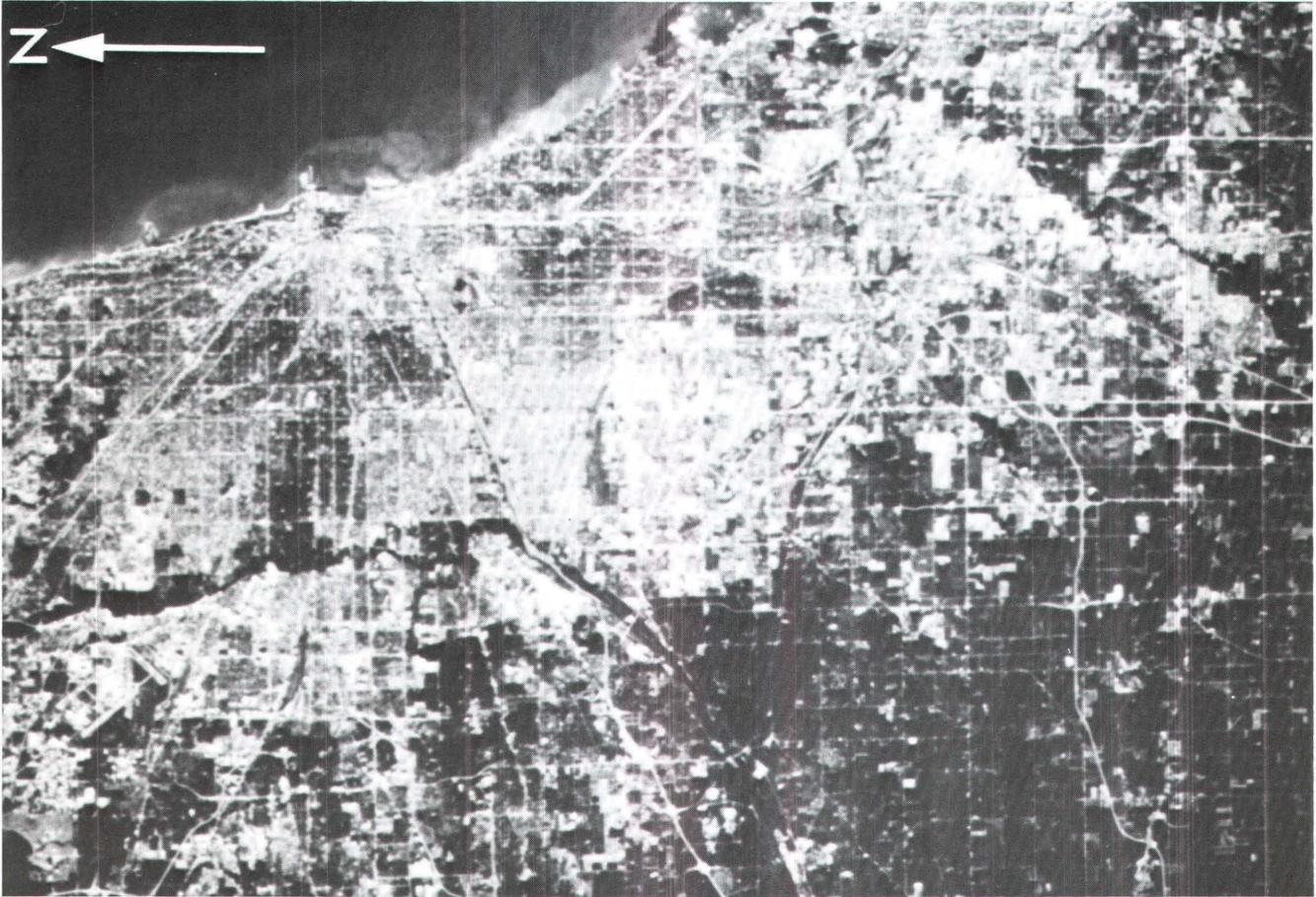


Figure 8. Skylab photograph of the Chicago, Ill., area, showing extensive spread of urban development. As a result, a number of quarries in this area have had to be abandoned. Some of the lightest colored areas are the sites of present or former quarries. Photograph from files of the Illinois State Geological Survey.

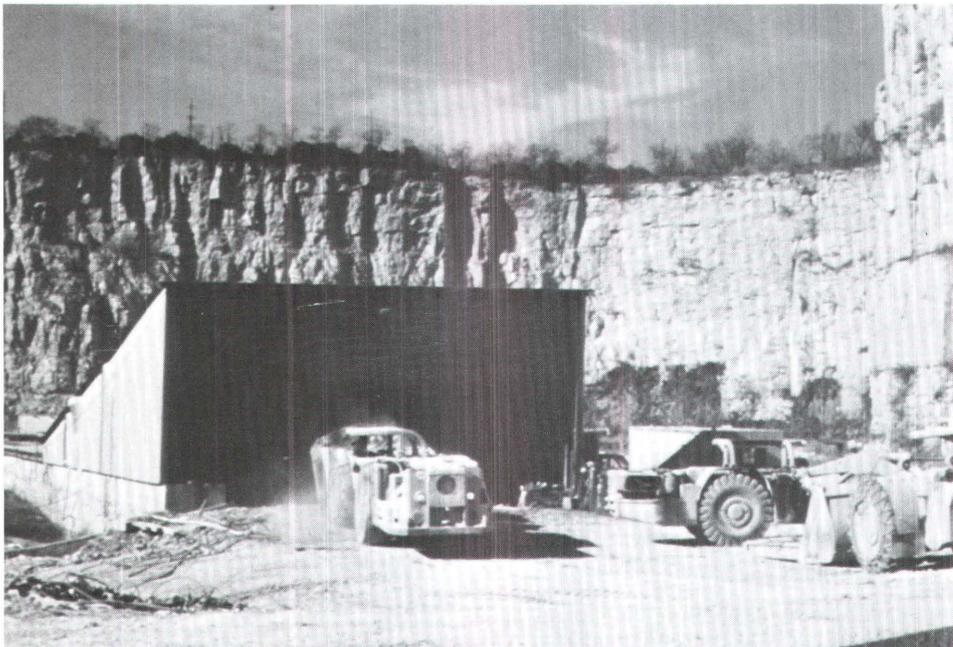


Figure 9. Underground mine for aggregate in the Middle Ordovician Galena Dolomite, converted from an open quarry, Chicago area. Photograph from M.W. Leighton, from files of the Illinois State Geological Survey.

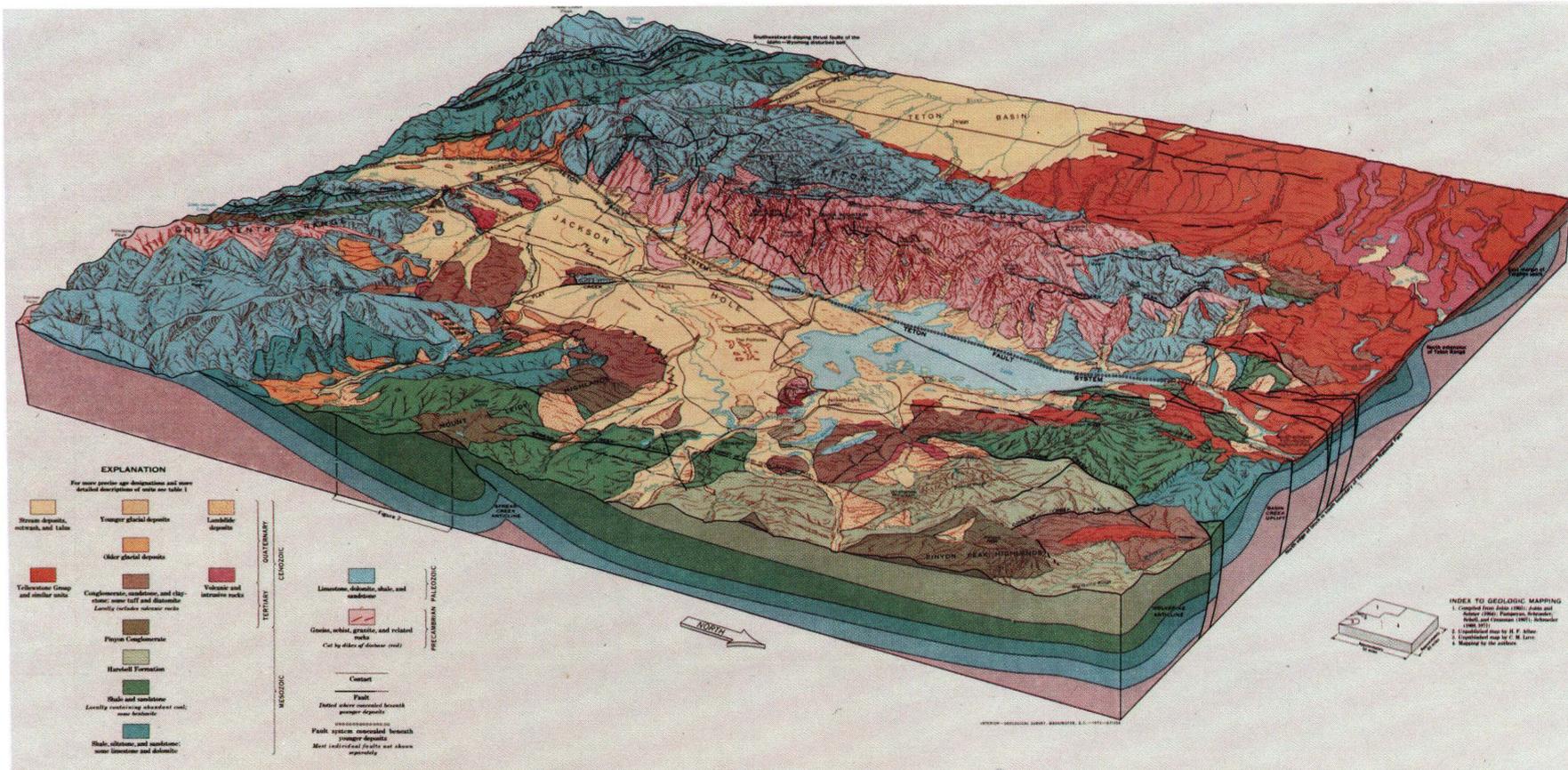


Figure 10. A geologic block diagram, showing the combination of topographic mapping, surficial geologic mapping, and interpretation of the geology to depict rock relationships in the third dimension. (Originally published in U.S. Geological Survey Map I-730, by J.D. Love, J.C. Reed, Jr., R.L. Christiansen, and J.R. Stacey, 1972.)

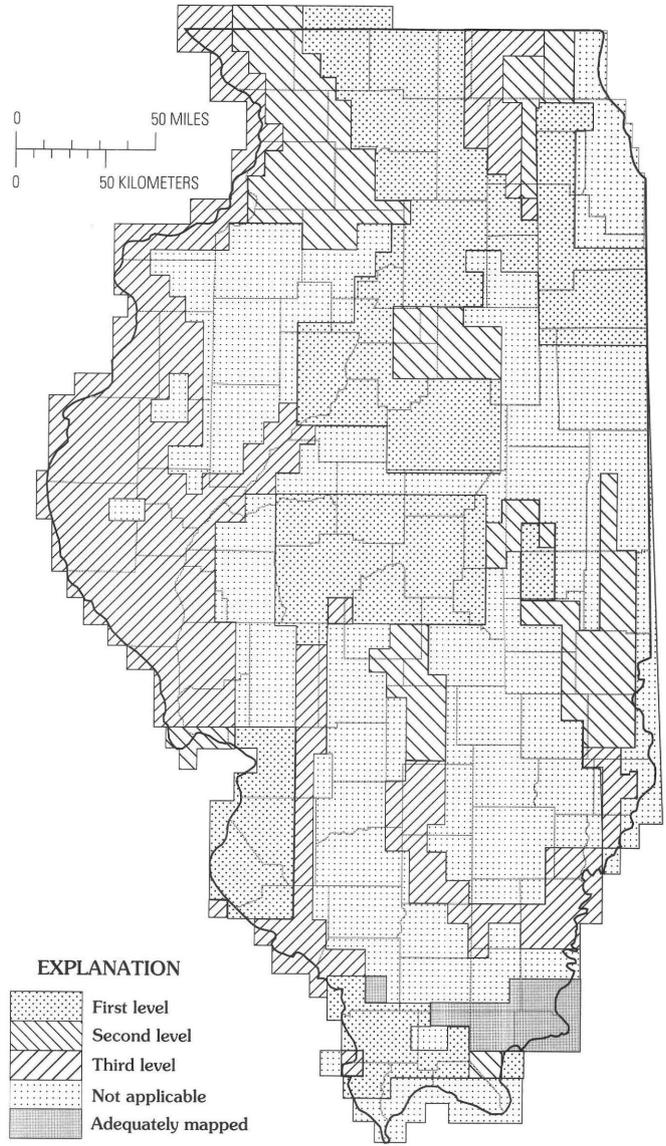
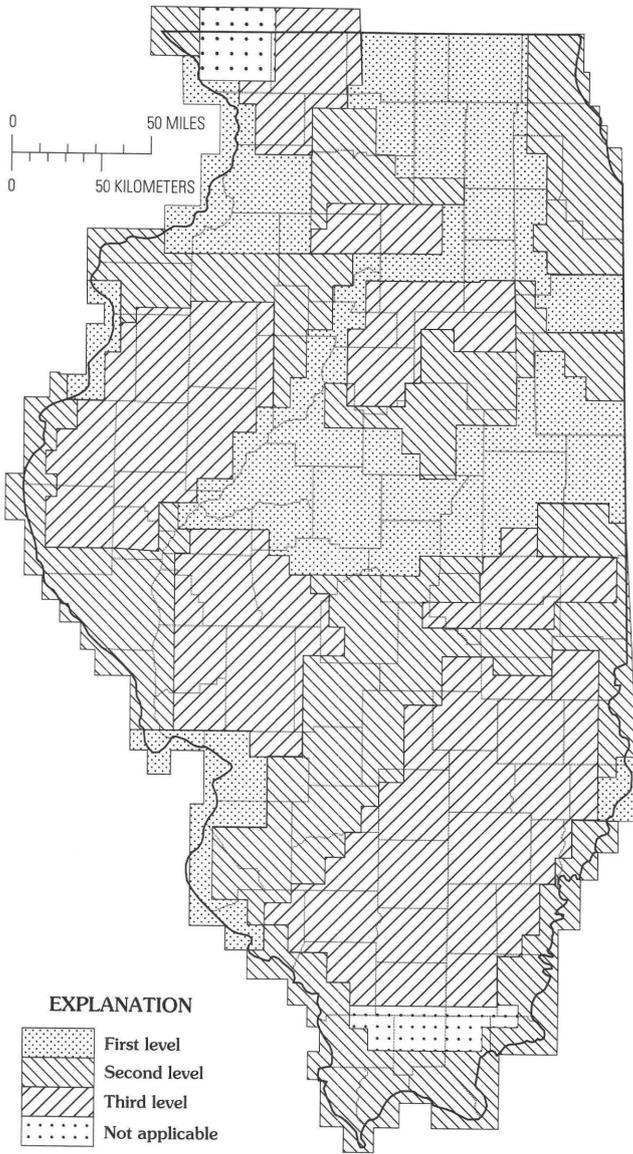


Figure 11. Status of mapping for sand and gravel in Illinois, showing areas adequately mapped as of 1991, and priority levels for future mapping.

Figure 12. Status of mapping for limestone, dolomite, and sandstone in Illinois, showing areas adequately mapped as of 1991 and priority levels for future mapping.

at a scale suitable for resource evaluation and estimation. The availability of large-scale geologic maps is a significant problem in most States. We have looked at this problem closely in Illinois (Illinois State Geological Survey, 1992), and a team of State geologists together with the USGS has examined the problem on a national basis. The rate at which detailed mapping is now being accomplished indicates that well over 200 years will be required to complete the task, both in Illinois and nationwide. Only 3 percent of the State of Illinois has been mapped at the 1:24,000 quadrangle scale.

With respect to detailed mapping of sands and gravels in Illinois, our assessment indicates that sand and gravel resource maps have only been compiled at the scale of 1 to

62,500 for selected Illinois counties and at smaller scales (1 inch equals 2 miles) for certain multi-county regions. However, there is no map coverage at 1:24,000. Such detailed sand and gravel maps should eventually be available for virtually the entire State (fig. 11), because construction using these low-unit-cost materials is required throughout the State. Highest level needs are the metropolitan areas with high population density and rapid development.

Limestone, dolomite, and sandstone resources in Illinois have been considered separately from those of sands and gravels (fig. 12). In Illinois, limestone and (or) dolomite (varieties of essentially carbonate rocks) are commodities used as aggregate in Portland Cement; as aggregate in

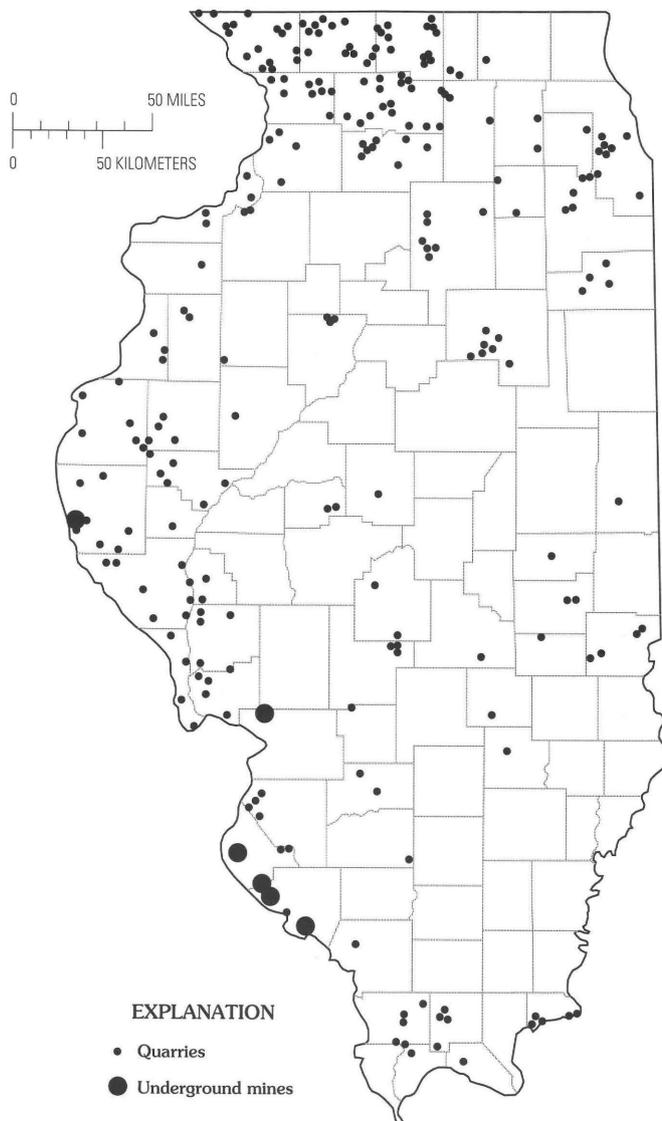


Figure 13. Location of limestone and dolomite quarries and mines, Illinois; note absence of quarries in the Peoria and Bloomington areas, and in the Springfield-Decatur-Champaign corridor.

concrete structures and in the construction of concrete and bituminous (black-top) roads. Carbonate rocks are a source of agricultural lime and also are used in various manufacturing and chemical processes. Sustainable supplies of both limestone (mainly restricted to the southern two-thirds of the State) and dolomite (predominantly in the northern third) are required to maintain a healthy construction industry and provide material to support industrial and agricultural uses.

Detailed mapping with application to quarriable limestone, dolomite, and sandstone resources (fig. 12) is largely restricted to unglaciated, rural areas where mapping has been related to other commodities (fluorspar, coal). A few 1:24,000 maps have been completed in southernmost Illinois. Less effort has been expended where bedrock is covered by glacial drift and around rapidly expanding urban

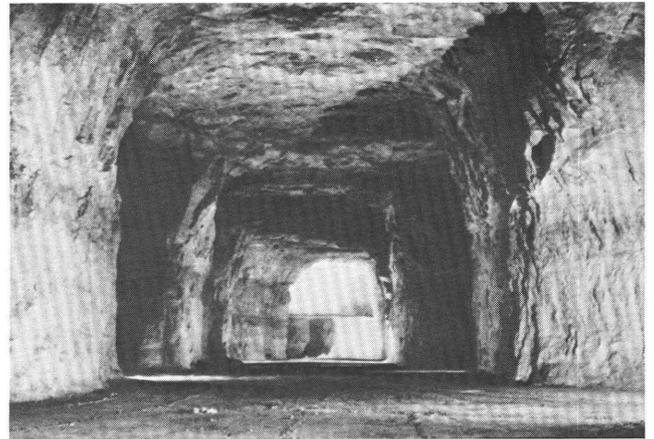


Figure 14. Underground mine for aggregate in the Upper Mississippian St. Louis Limestone, St. Louis area, Missouri. Photograph from M.W. Leighton, from files of the Illinois State Geological Survey.

areas where demand for crushed stone is particularly high. Highlighted in this assessment is the need for detailed 1:24,000 geologic maps of bedrock surface in the counties surrounding rapidly expanding urban areas to help locate limestone, dolomite, and sandstone resources. We note also that detailed mapping should be extended along the Illinois and the Mississippi Rivers and to areas underlain by older carbonate rocks also down in southern Illinois.

In addition, we have flagged areas near developing communities which may appear to have some limitation in growth potential inasmuch as there are no nearby quarries. The lack of quarries in those areas is documented in figure 13. Note especially the absence of quarries in central Illinois near Peoria and Bloomington and in the corridor from Springfield, through Decatur to Champaign (fig. 13). The potential for underground mining in these areas, similar to that initiated in Chicago and already underway near St. Louis, requires study. One of the underground mines in the St. Louis area is shown in figure 14. The utilization of underground space, in such cases, may offer added economic incentive.

Some of the factors that need to be considered in determining the feasibility of underground mining include: (1) the market situation, including market demand and distance to market; (2) depth to a minable thickness of limestone and dolomite; (3) chemical and physical character of the minable stone; (4) bedding characteristics of the minable stone; (5) presence or absence of bedding planes that may be chosen as the roof and the floor of the mine; (6) local and regional ground-water conditions; (7) character of the overburden and presence or absence of an impermeable layer superjacent to the potential mine; (8) availability of mineral rights; (9) land-use and zoning regulations; (10) subsidence potential; (11) potential for subsequent use of the created underground space; and (12) environmental considerations.

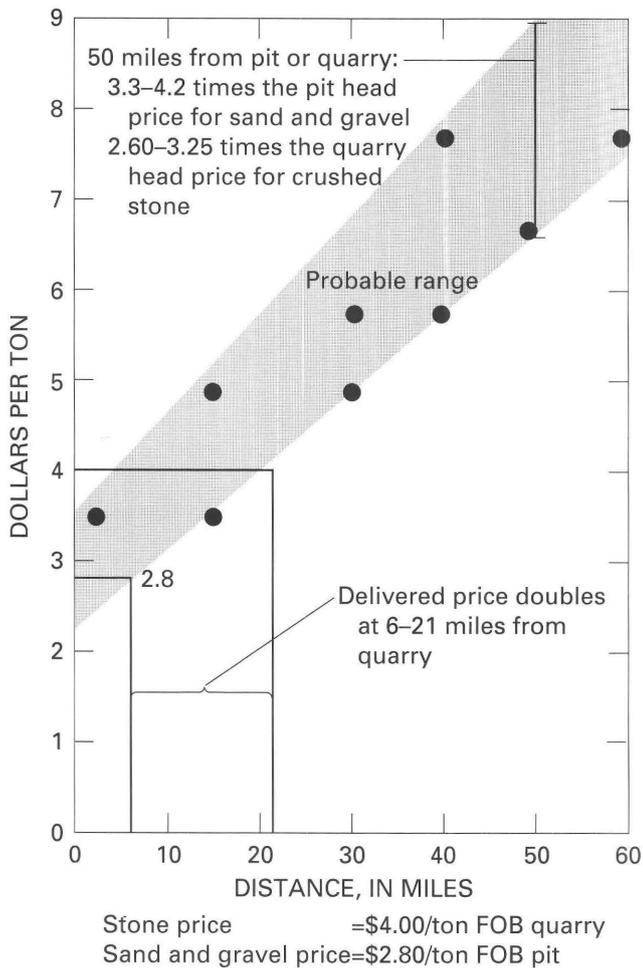


Figure 15. Relation between cost of aggregate and transportation distance by truck to site of use, as of 1989. Diagram modified from Bhagwat (1989).

Transportation costs are, indeed, a major consideration in selecting sites for obtaining construction aggregates, whether such sites are underground or at the surface. The relationship of transportation cost of aggregates to the distance between the delivery point and the source was investigated by Subhash Bhagwat, of our Mineral Economics and Strategic Planning Section, from a compilation of scattered data (fig. 15). To obtain the delivery price, the FOB price at the quarry or pit must be added to the transportation cost that is illustrated in figure 15. The data suggest that at 6–21 miles from the quarry, the price of the delivered aggregates is nearly doubled, and at 50 miles the price is about three times the quarry price (Bhagwat, 1989).

In a recent letter from an industry representative, both depth of overburden and transportation costs were highlighted as major considerations. While the structure in northern Douglas and southern Champaign Counties commonly referred to as the Tuscola anticline was known to exist as early as 1916, it wasn't until about 1972 that Keith Walker of Shakespeare Oil noted that a map in a then-recent Illinois

State Geological Survey (ISGS) bulletin showing overburden thickness in and around Tuscola could be useful in locating a quarry. Using that map the company determined "the most likely spot for a rock quarry, that is a place where there was the least amount of overburden" (Harry Temple, personal commun., 1987). Removing overburden at a cost of \$4–6 a yard was regarded as a very expensive item for them in opening a quarry. The map proved to be correct, and a quarry was opened. He estimated that "just by being located in that particular area means that farmers, the county, and State of Illinois get their rock in that area at about a dollar per ton less than they were otherwise paying. This would be due to trucking alone." Based on tons of production per year, he calculated a savings of \$250,000 to \$500,000 per year for the farmers, the county, and State. He went on to note that probably that quarry would be there for 50 years and with an average tonnage sold a year of 300,000 tons, a total savings would be \$15 million over 50 years. He recognized that such payout represents a very good return on the effort put out by the ISGS in mapping that area. The need for such mapping elsewhere still exists, and similar considerations of transportation costs and depth of overburden still exist, driving industry's choices on selecting suitable quarry sites. The same considerations affect our priorities for detailed geologic mapping.

The value of geologic maps in locating and outlining industrial mineral deposits should, by now, be apparent. They help to focus industry and government interest on specific, suitable areas for economic development.

Other needs in establishing the economic availability of industrial minerals are identified in the following table.

Other needs

1. Drilling, sampling, testing for quantity and quality.
2. Estimating mining costs.
3. Integrating technical and operational data.
4. Assessing legal and regulatory climates.
5. Assessing impacts, both legal and environmental.
6. Streamlining regulatory processes.
7. Analyzing economics and determining benefits/costs.
8. Developing needed research and service support.

In general, drilling and sampling and testing for quality are carried out by private industry when markets have been identified. However, State agencies can contribute to this identification and to the maximum utilization of resources by mapping, preliminary testing, and cost estimation. The goal of such a program should be to prioritize deposits on the basis of the estimated mining costs. Estimated mining costs can be determined by establishing costs versus minable quantity relationships and by simulation modeling of mining operations. This should be especially applicable to the underground mining of stone. Priority for such efforts, as we have noted, should be given to major metropolitan areas and the corridors connecting them because aggregate consumption is greater in these areas (Bhagwat, 1989).

Economic analyses and data handling can be significantly facilitated by modern computer systems and software. The Geographic Information System (GIS) permits the comparison of digitized geologic maps and the quantity and quality of resources with any demographic information. Road networks and populations can be directly compared with resource locations. GIS can further be of use in developing transportation cost estimates based on the knowledge of the location of the deposits, the locations where the stone is used, and the rural and urban highway transportation mileage involved (Curran, Bhagwat, and Hindman, 1988). Also, benefit/cost analyses should prove helpful in reaching ultimate decisions on allowing access to these resources (Bhagwat and Berg, 1991).

Government agencies can use the knowledge so developed in the planning of industrial zones, permitting urban growth, and protecting the environment while assuring continued economic growth. Cooperation among government agencies (at all levels) and the industry is crucial in ensuring that industrial mineral resources are economically available for future generations.

Under cooperative arrangements that streamline procedures, industry can be expected to respond appropriately in planning the mining and transportation of industrial minerals. The State, counties, and communities can contribute to the effort by declaring their development and environmental plans well in advance. The permitting procedures constitute major cost factors in resource development and need to be addressed and satisfactorily resolved. Advance knowledge of government policies, plans, and intentions facilitate low-cost, long-range planning and commitment on the part of industry. If a cooperative effort can be developed to protect the environment while making the best use of resources, the overall economic and environmental benefits to society will be realized.

Finally, service and research needs for a healthy industry also must not be neglected.

Research goals identified by representatives of the Illinois Department of Transportation (IDOT) at a recent meeting of an Illinois Aggregates Task Force indicated the need to pursue a number of research areas, including (1) the development of automatic sieve analysis, (2) the curtailment of the generation of "fines," (3) the establishment of the minimum size of test samples, (4) improvement in the precision and reproducibility of sodium sulfate soundness tests, (5) better quantification or the development of substitute tests for the "soft and unsound" portion of deleterious materials in deposits of sand and gravel to be used in Portland Cement concrete, i.e., the hurtful, damaging components such as ironstone, shale, and various weathered rocks that are more susceptible to wear, cracking, expansion, and decomposition than other rock types, (6) the determination of a simple but quantitative means for dust measurements and for the impact of sand angularity on the performance of high-quality mixes, (7) the development of a program to predict currently

unrecognized geologic variability in deposits, (8) the detection and remediation of undesirable effects on concrete of water-soluble salts in Illinois bases, sub-bases, and soils, and (9) the development of an accurate permeability test as an aid to improved drainage of highway bases and slabs.

The issues related to sustained economic availability of industrial minerals are thus many and varied. To sum up, the availability of sufficient quantities of industrial mineral resources to maintain and expand existing infrastructure is not "a given." Information on the economic availability of resources is not "on the shelf." Detailed geologic mapping in priority areas is required. Their evaluation is also dependent on (1) data on quantity and quality; (2) compilation of logistical and demographic factors; (3) integration of technical and demographic/logistical data; (4) analyses of regulatory and legal climates; (5) impact analyses—including those of a regulatory, environmental, and research nature; and (6) economic studies that consider the legal and regulatory aspects and the overall benefit/cost. Sufficient economic quantities of industrial mineral resources to maintain and expand the State's and the Nation's infrastructure will require a regulatory environment that permits reasonable access to resources. The economic building and rebuilding of the State's and the Nation's infrastructure will be feasible only if industrial minerals are available at the right place, in the right amount, with the right quality, at the right price, under the right incentives.

REFERENCES CITED

- Bhagwat, S.B., 1989, Model of construction aggregates demand and supply—A Chicago area case study: Proceedings of the 23rd Forum on Geology of Industrial Minerals, May 11–15, 1987, Illinois State Geological Survey IMN 102, p. 29–34.
- Bhagwat, S.B., and Berg, R.C., 1991, Benefits and costs of geologic mapping programs in Illinois—The case of Boone and Winnebago Counties and its statewide applicability: Illinois State Geological Survey Open File Series 1991–5, 1991, 57 p.
- Curran, L.M., Bhagwat, S.B., and Hindman, C.A., 1988, Disposal alternatives for material to be excavated from the proposed site of the superconducting super collider in Illinois, Illinois State Geological Survey EGN 125, 1988, 17 p.
- Illinois Department of Commerce and Community Affairs, 1989, A five-year plan, 1989: State of Illinois, 50 p.
- Illinois State Geological Survey, 1992, Geologic mapping for the future of Illinois: Illinois State Geological Survey Special Report 1, 49 p.

Timothy S. Hayes:

Let's move into another area of issues and turn to the questions of land-use planning for the availability of industrial minerals. We have with us Mr. Ed Sieben from the Kane County Development Board in Geneva, Illinois.

LAND-USE PLANNING TO ENSURE INDUSTRIAL MINERALS AVAILABILITY

Edward T. Sieben, Kane County Development Board, Geneva, Illinois

Good morning. I am a Senior Planner with the Kane County, Illinois, Development Department. Our Development Department includes not just planning, but also zoning, subdivision review, and building inspections. Therefore, I would like to talk a little today about our experiences in Kane County with land-use planning as it relates to mineral resource preservation and then some of the regulations related to mineral resource extraction and reclamation.

First a little background on our county. Kane County is part of the Chicago metropolitan area, located about 45 miles due west of downtown Chicago. The Fox River is basically our eastern border and really our urbanized area, with all of our largest cities, along the river. Our population is about 320,000, with the majority, about 89 percent, located along the Fox River along the eastern edge of the county. There is great population pressure pushing from the east. The fastest growing county in the State is Du Page County on our eastern border. Kane County itself has doubled in population since 1950, and we increased by 14 percent during the 1980's. In comparison the State of Illinois grew less than 0.1 percent during the 1980's. Two tollways come from the Chicago region (Northwest Tollway, I-90, and the East-West Tollway, I-88).

A land-use plan of the county from 1976 (fig. 16 [later plan, fig. 17, placed alongside for comparison]) shows our early efforts to concentrate future growth along the urbanized eastern edge and also around our rural villages. We have several small villages throughout the county where we are trying to concentrate growth. While we do this, we preserve prime farmland and therefore any mineral resources that may lie underneath.

One of our larger cities, Aurora, has a population of 100,000 people, so it makes up almost a third of our whole county. It's Chicago's largest suburb, although it really is a city in itself. It is predicted that, by the year 2010, it will be Illinois' second largest city with about 146,000 people. Our second largest city, Elgin, in the northern part of the county, has a population of just over 70,000 people. And St. Charles, in the center of the county along the river, actually on the eastern edge, is our third largest city, with about 25,000 people.

One of our unincorporated rural villages in western Kane County is appropriately named Big Rock; it has a population of about 500. We range from a city of 100,000 to a couple of hamlets of less than 50 people; we really have quite a variety within the county.

The Fox River is one of our most valuable resources, and we have tried to preserve its quality and use for the public's benefit; figure 18, for example, shows one of our bike trails along the edge of the river. We also try to protect

from development other natural resources such as streams and other natural areas. However, one of our main areas of concern is the preservation of a large amount of Kane County's prime farmland, which is among the best in the world. Approximately two-thirds of Kane County is still in agricultural production, including 83 percent of the unincorporated areas, over which the Development Department has jurisdiction.

Along with preserving prime farmland, we are also preserving subsurface mineral resources for possible future extraction. Development pressures from Chicago, plus the relatively cheaper prices for farmland, make it essential to try to steer development away from some of these potential resources. Among the converted uses of the farmland have been golf course developments; in fact, right now, we have two 700+ acre developments in the planning stages. One of them just got preliminary plat approval and the other one is still trying to get concept plan approval.

Residential subdivisions are expanding into the central part of the county where the average price of a new home is about \$250,000. Office buildings are popping up on the western edges of Aurora and Elgin along the two tollways, so we face construction expanding into these farm areas. There is quite a contrast. We must protect future mineral resource areas before they are developed upon. The mineral resources of Kane County have historically been a source of materials for many of the county's homes. Our stone has been used to build our churches and government buildings, for example, the current City of Batavia City Hall, which was a former windmill factory built in the late 1800's. Batavia has a population of about 15,000.

For the last three decades, Kane County has usually been the second leading producer of sand and gravel among counties in Illinois. In 1978, over 6,000,000 tons were mined, and we are also a leading producer of dolomite.

Kane County's current land-use plan was done back in 1982 (fig. 17). We are in the process of updating it right now, but it still reflects our thinking in many areas. The gray areas on the map, along the river, are the incorporated areas over which we do not have jurisdiction. Orange areas are those planned for the expansion of these urban areas. Basically we took the land-use plans that were in existence at the time for the different cities and showed where they would soon be expanding, with different residential development at urban densities. This is consistent with our earlier plan of concentrating urban development along the river cities or at rural villages where infrastructure such as sewer and water lines and other services can be expanded. The yellow areas are planned for rural residential uses, with generally 1-2 acre lots with wells and septic tanks. For example, we have a relatively heavily wooded area to the west of the city of St. Charles where the land is a little bit rolling. In the past 30 years this area has been undergoing residential development, so we are trying to concentrate it within certain areas here. These areas shown as residential can hold 100,000-150,000

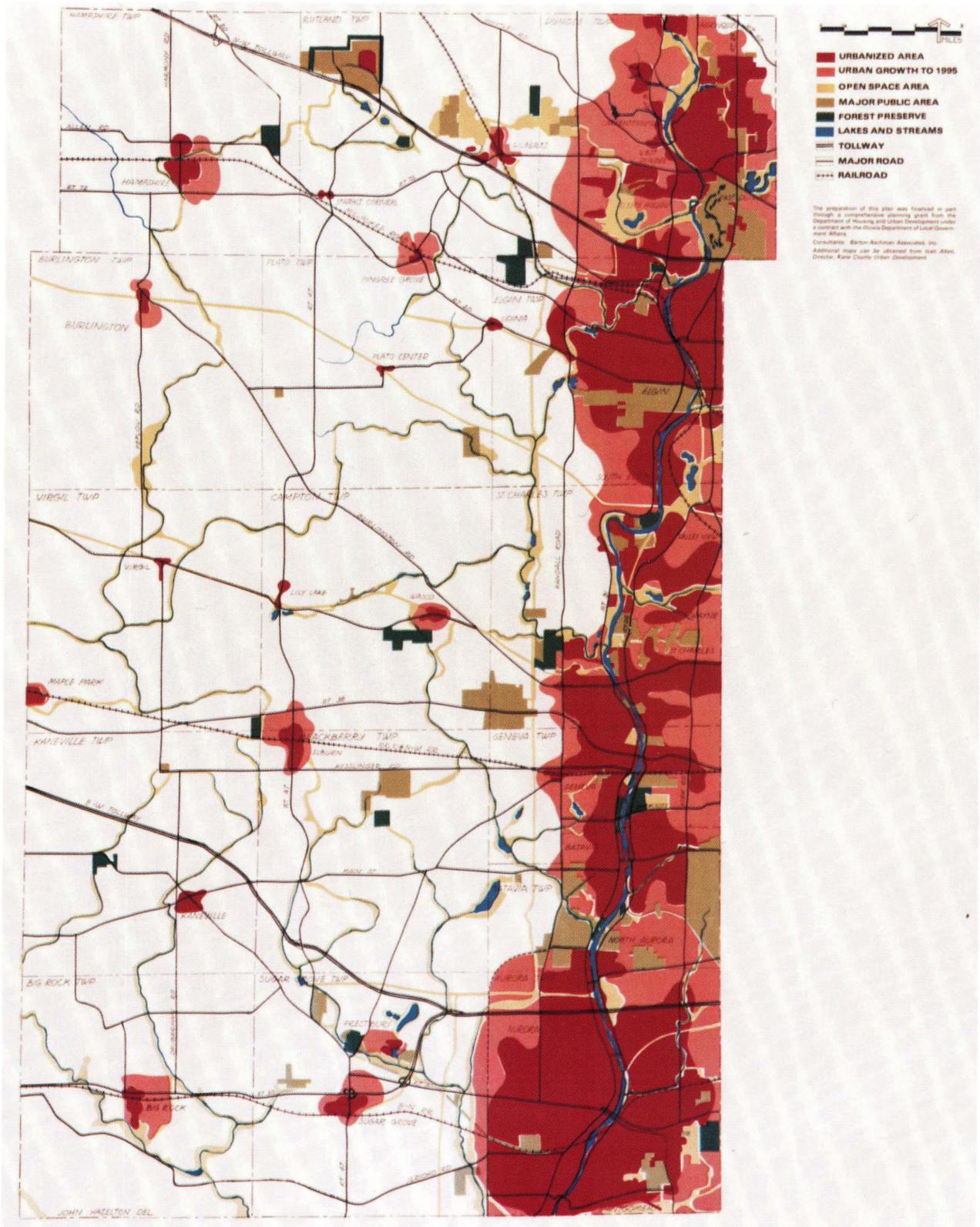
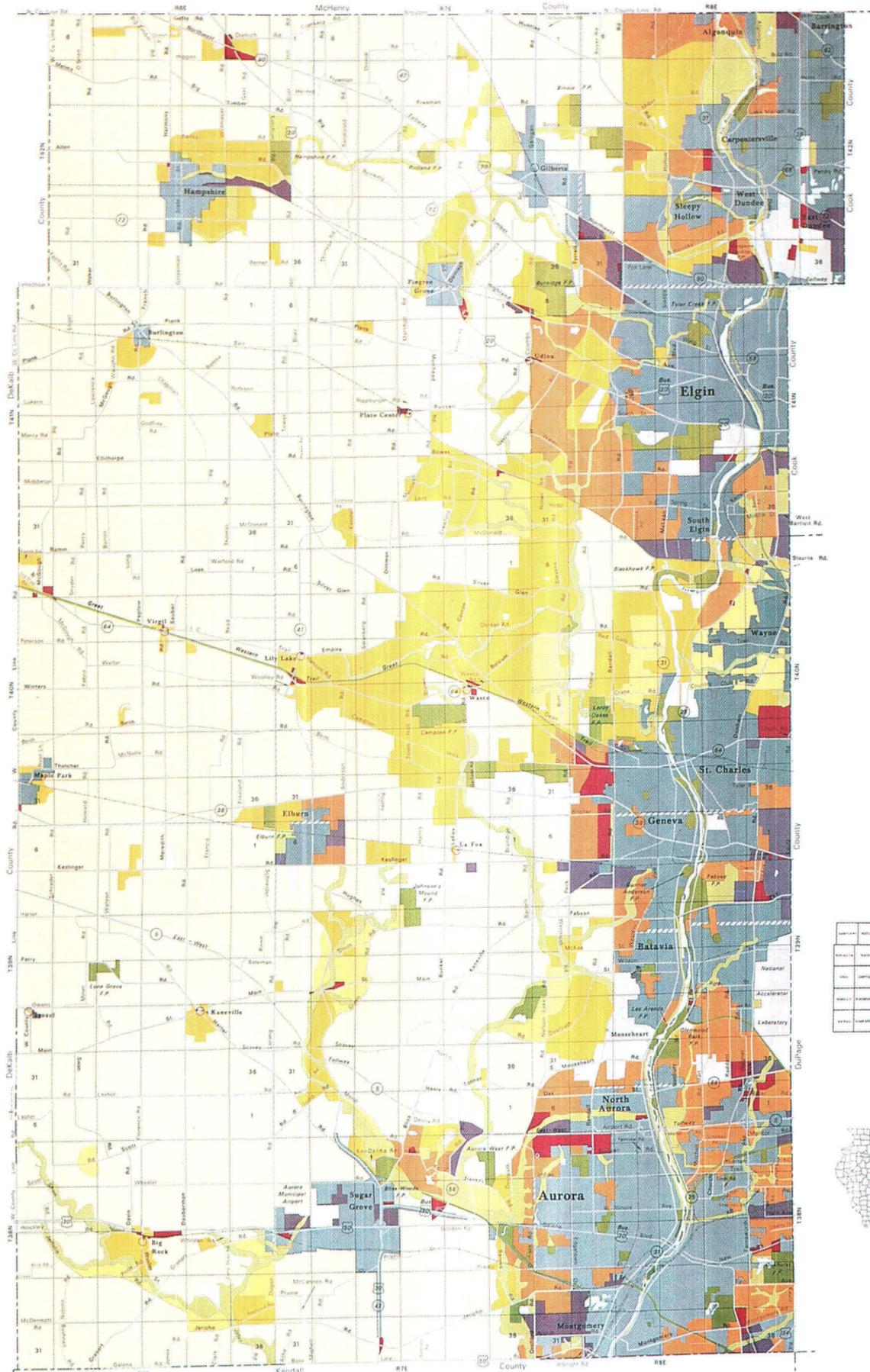


Figure 16. Generalized land-use plan, 1976, Kane County, Ill. Preparation of this plan was financed in part through a comprehensive planning grant from the Department of Housing and Urban Development under a contract with the Illinois Department of Local Government Affairs (Consultants: Barton-Aschman Associates, Inc.).

Figure 17 (facing page). Comprehensive land-use plan, 1982–2000, Kane County, Ill. ►



- Residential / Countywide Estate (4 acres or more per dwelling unit)
- Rural Residential (1.5 - 4 acres per dwelling unit)
- Urban Residential (multiple dwellings and water)
- Commercial, Office, Research
- Industrial, Light Industrial, Warehousing
- Existing Open Space
- Proposed Open Space, Conservation, Recreation, Drainage Area
- Agriculture
- Institutional, Private Open Space
- Water
- Incorporated Municipality



**KANE COUNTY
COMPREHENSIVE
PLANNING PROGRAM**

Kane County Development Department
Geneva, Illinois 1982
Prepared by: GRIFFIN
LAWRENCE STEVENS, CAROLYNNE EGGERT
JOHN HARRIS, CAROLYNNE EGGERT
Production assistance provided by the Northern Illinois University
Laboratory for Cartography and Digital Analysis



Base data from U.S. Geological Survey map of Kane Co., scale 1:500,000, 1978



Figure 18. Bicycle trail at Geneva Dam on the Fox River, Kane County, Ill. Original transparency by E.T. Sieben.

people in excess of the population forecast, in order to give some leeway to developers. Kane County's year 2010 forecast is for about 430,000 people, so that's about 110,000 more than we have now.

The majority of central and western Kane County is planned for agricultural uses, about the western two-thirds of the map. With the use of the agricultural zoning category, potential mineral resource areas can be protected from development.

It became increasingly important that as part of our planning program we needed not only to document the distribution of mineral resources (as we did in the plan), but also to adopt policies that would preserve the resources for future exploitation, ensure reclamation, and allow for other future use. To briefly state some of the county's policies in our current land-use plan, number one is to discourage development, on or adjacent to minable mineral deposits, which might eventually interfere with mineral extraction or recharge of shallow aquifers. Two, allow well-controlled expansion of existing sand and gravel pits and dolomite quarries when consistent with adjacent land uses. Three, encourage the opening of new mineral resource areas for extraction, considering the county and regional growth forecast and market conditions. Four, require land reclamation plans before extraction is permitted and require adequate buffer zones between mining operations and potentially incompatible land uses. Five, encourage research by county or other agencies on improved mining and reclamation techniques, and finally, six, is what we have been doing for the last couple of years, cooperating with the Illinois State Geological Survey and other State or Federal agencies in

identifying and more precisely mapping areas of mineral deposits.

Figures 19–22 show four of the maps that Morris Leighton and his staff have been doing for us, some of the mapping he's been talking about. Among them they show the potential for mineral resources in the county (fig. 19) and we also have a few other maps such as the bedrock topography of Kane County (fig. 20), distribution and thickness of the Tiskilwa Till [Member of the Wedron Formation] (fig. 21), and a stack unit map for the county (fig. 22). The long-term benefit will be the protection of mineral resources for future generations and will help long-term economic development.

Briefly, now, touching upon regulation and reclamation, the Kane County experience shows that it must be reasonable. Through the zoning ordinance, mining is allowed by the granting of a special use within the F-farming district. A mining operation license, good for 5 years, is also required. An approved reclamation plan is required by the licensing process. Semi-annual, on-site inspections check the status of the reclamation plan for the area already mined. If reclamation is not up to standards, the license can be revoked. A performance guarantee in the form of a letter of credit is also required. The county can default if the work is not being done, and the county can use these funds to make sure the reclamation is done right.

In conclusion, Kane County is well aware that there are reasonable limits to the level and amount of regulation. We realize it's an important economic activity to provide reasonably priced construction materials for future development. Over-regulation and reclamation may make extraction

unprofitable. The lack of regulation is also bad because it may lead to State preemption of local control and would likely lead to poor land-use planning. There must be a balance then between no regulation and too much regulation, which requires cooperation among the State, counties, and owners and operators. We all must realize the need to plan widely for future extraction of mineral resources. In summation of our strategy, then, are the two "P's"—Plan and Preserve—and the two "R's"—Regulate and Reclaim.

Timothy S. Hayes:

The next issue we will consider deals with the economics of industrial rocks and minerals in construction, and to present some of the facts of that issue is Aldo Barsotti, the Chief of the Industrial Minerals Branch of the U.S. Bureau of Mines.

ECONOMIC LIMITATIONS ON INDUSTRIAL MINERALS AVAILABILITY

Aldo Barsotti, Chief, Branch of Industrial Minerals, U.S. Bureau of Mines

In 1986, the U.S. Bureau of Mines was asked by the Director of the Minerals Management Service, an agency in the Department of the Interior, to do an economic reconnaissance of the mineral resources offshore in the Exclusive Economic Zone (EEZ), the area between 12 and 200 miles offshore. Little information was available on the resources in this area, so we took an engineering parametric analysis approach, using the little information already available, and divided the study into two parts; one was on heavy minerals and the other on aggregates. We then looked at seven cities, and examined the current markets for aggregates in those cities. This includes the demand for and the resources of aggregates in each metropolitan area. The cities were Boston, New York, Houston, Los Angeles, San Francisco, Honolulu, and San Juan, Puerto Rico. We found that every city was having problems, suffering from a shortage of aggregate resources. Transportation was a major factor. We also found that for New York and Boston, it would be economically feasible to mine aggregates known to exist offshore, using conventional dredges and delivering from as far as 100 miles offshore to the center of the city. There are other factors besides economics that enter into the picture and that prevent mining from happening, but essentially we found that given current market conditions and methods, there is a potential for mining resources offshore economically. That led the Bureau to look more seriously at methodologies for evaluating resources.

A little over a year ago, the Bureau of Mines began a study of infrastructure, material costs specifically, trying to measure the cost of aggregates as a percentage of

infrastructure costs. This chart (fig. 23) basically shows what we are trying to do. The first bar on the right represents the general components of infrastructure costs. As we heard from Dr. Kane, total infrastructure costs could be between \$124 and \$152 billion. These then would be the components of that amount. Could those components be quantified? If so, could we then delineate the components of material costs, i.e. aggregates, steel, cement, and other materials? And if so, could we then further delineate the cost of individual components in order to identify their significance compared to the total cost of the infrastructure. With that as our objective, we have been trying for about a year and a half to come up with individual costs for these components. One study completed was on the new airport in Denver, a 1.7 billion dollar project. Our study came up with an estimate that the cost of aggregate would be somewhere between 16 and 20 percent of the total \$1.7 billion cost. We also have been trying to decipher and evaluate data from other agencies to identify material costs in total infrastructure costs. In that regard we have been working with the Illinois State Geological Survey. We have had some failures, but we also have had some success.

Now, as this is a Workshop, I suggest that both authors who have worked on these projects give their presentations. The two professionals are Val Tepordei, who is the Aggregate Commodity Specialist for the U.S. Bureau of Mines, and Subhash Bhagwat, who is the Mineral Economist for the Illinois State Geological Survey.

MATERIALS—A MAJOR COMPONENT OF THE INFRASTRUCTURE—I

Valentin V. Tepordei, Branch of Industrial Minerals, U.S. Bureau of Mines

Public works projects represent a very significant part of the construction activities in most areas of the country. The importance of public works for promoting economic development and national defense has been recognized since the founding of the Nation. The basic facilities, equipment, services, and installation needed for the functioning and the growth of a country, community, or organization became known as the infrastructure. Since the beginning of this century, the Nation's infrastructure has grown enormously. Much of the core infrastructure, like bridges, water systems and sewers, in use today in America's older cities, was put in place during the first half of this century. The post-World War II period witnessed an even greater growth. In 1956, the U.S. Congress created and designated the National System of Interstate and Defense Highways, also known as the Interstate Highway System and created the Highway Trust Fund to finance its construction and maintenance. The project was intended to promote interstate commerce, maintain the Nation's international competitiveness, and strengthen

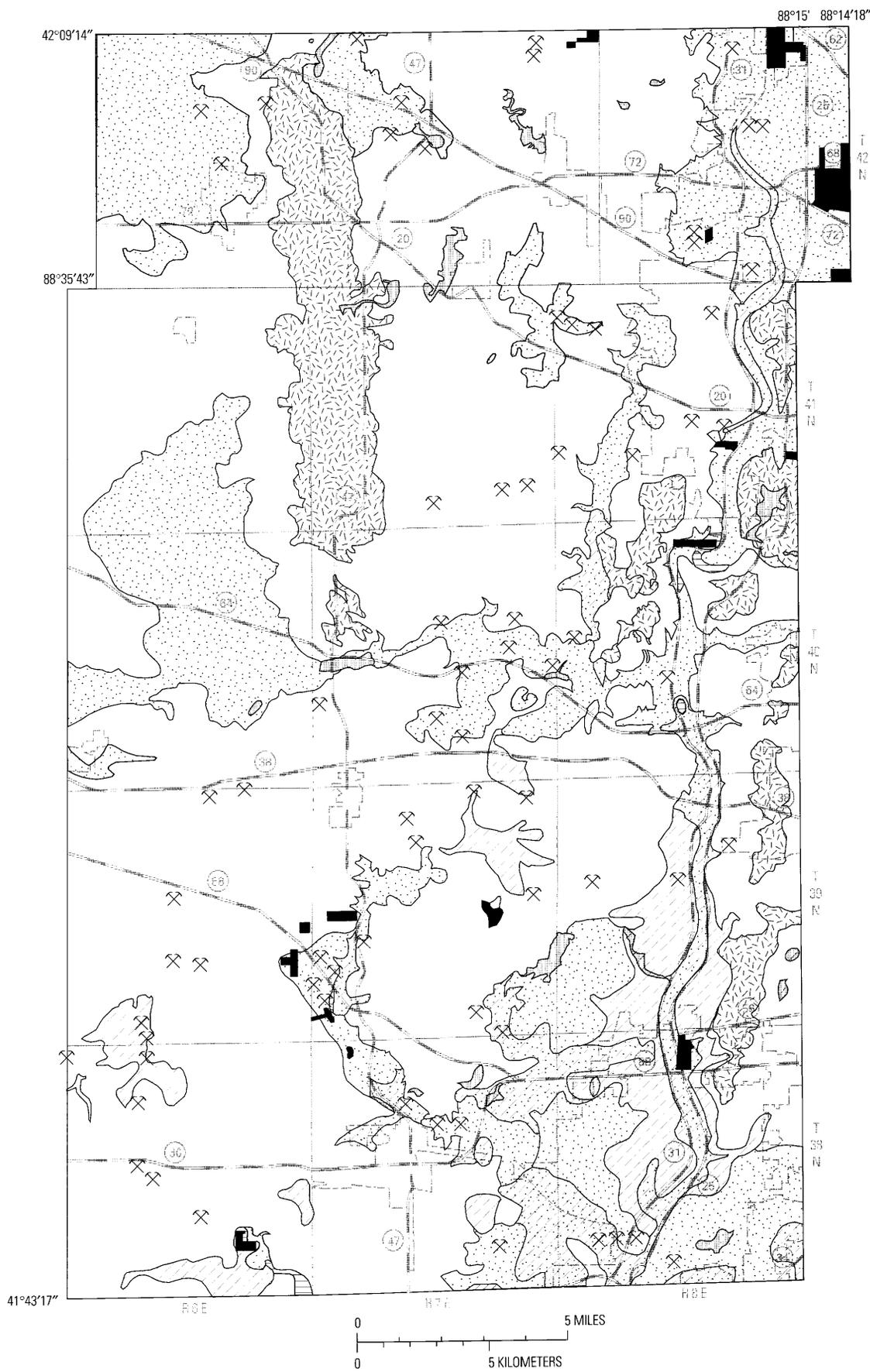


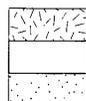
Table 1. Production of aggregates in the Central States region.

	1989			1990		
	Cr. Stone	Sand & Gravel	Total	Cr. Stone	Sand & Gravel	Total
			Aggregates			Aggregates
Arkansas	18,791	7,500	26,291	17,800	8,600	26,400
Illinois	60,829	33,000	93,829	62,700	33,600	96,300
Iowa	28,049	12,800	40,849	29,000	12,100	41,100
Kansas	15,850	13,000	28,850	20,800	13,800	34,600
Kentucky	48,178	5,500	53,678	50,100	6,300	56,400
Missouri	51,754	10,000	61,754	53,100	12,200	65,300
Nebraska	3,978	15,200	19,178	4,000	16,800	20,800
Oklahoma	23,598	8,500	32,098	25,300	7,100	32,400
Tennessee	52,917	6,100	59,017	54,600	5,500	60,100
Total Region	303,944	111,600	415,544	317,400	116,000	433,400
as % of U.S. total	25.0%	12.4%	19.7%	26.0%	12.5%	20.2%
Total U.S.	1,213,400	897,300	2,110,700	1,222,000	927,100	2,149,100

Source: U.S. Bureau of Mines.

EXPLANATION

Potential for development of sand and gravel resources



Low

Moderate

High

Geologic and hydrologic features



Dolomite within 50 ft of surface

Shale within 50 ft of surface

Wetlands and lakes

Pits and quarries



Small

Large



Road



Municipal boundary

Figure 19 (above and facing page). Earth materials of Kane County, Ill. Modified from Curry, B.B., 1990, Earth materials of Kane County (computer cartography by A.L. Erdmann): Illinois State Geological Survey Open File 1990-2d, scale 1:62,500.

national defense. It became the single largest public works project ever undertaken by a nation. A period of constant growth and rapid economic development followed into the seventies. During the construction of the Interstate Highway System, the value of public construction works as a share of the Gross National Product (GNP) was about 3 percent. As the construction of the Interstate Highway System approached completion, the value of public construction work started to decline from 3 percent of the GNP in the fifties and sixties to about 2 percent in the seventies and 1.7 percent in the eighties.

Materials in general, and aggregates in particular, are an important part of the infrastructure. A significant amount of

crushed stone and construction sand and gravel is being produced in the Central States region (table 1). Twenty-six percent of total U.S. crushed stone, 12.5 percent of total U.S. construction sand and gravel, and about 20 percent of total U.S. aggregates (crushed stone and sand and gravel combined) are produced in the nine States of the region. Major producing States in the region are Illinois, Kentucky, Missouri, and Tennessee. The Surface Transportation Assistance Act of 1991, submitted to the U.S. Congress by the Bush Administration, proposes a substantial increase in Federal funding for surface transportation programs for fiscal years 1992 to 1996. [Editors' Note: In December 1991, The Intermodal Surface Transportation Efficiency Act of 1991 was signed into law. The Act includes a number of funding increases.] Highway programs would increase 39 percent, transit capital investments would increase 25 percent, and funding for highway safety activities would rise by 34 percent. Total funding for these activities would amount to more than \$105 billion over a 5-year period. State and local projects, financed mostly by State gasoline taxes or toll fees, are not included in these programs. While there is a lot of debate at the national as well as the State level about how much funding would be needed to fix and improve the Nation's infrastructure, or how to finance these programs, not too much is being said about how to better use these funds. A look at the major components of the infrastructure projects would help us understand their importance and the impact they will have on the cost of the programs.

The Bureau is doing studies in this area, and for the purpose of this Workshop we concentrated on the Central States region. Since the beginning of the construction of the Interstate Highway System, the Federal Highway Administration (FHA) and the State Departments of Transportation have been collecting and publishing information on the cost and

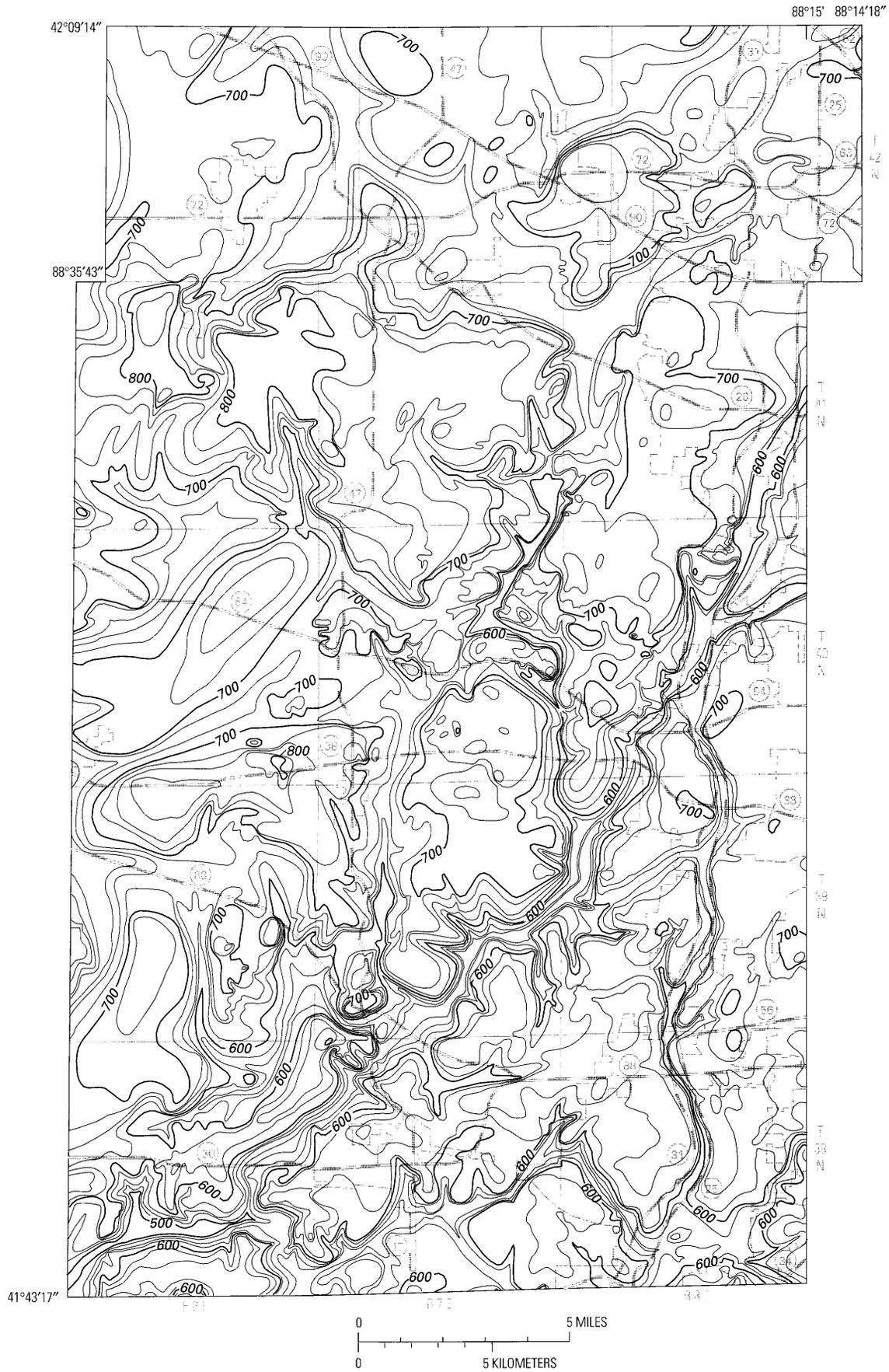


Table 2. Estimated U.S. highway construction expenditures.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Gross National Product (Billion)	\$2,732.0	\$3,052.6	\$3,166.0	\$3,405.7	\$3,772.2	\$4,014.9	\$4,231.6	\$4,515.6	\$4,873.7	\$5,200.8
All Public Highways (Billion)	\$17.4	\$17.0	\$15.7	\$16.6	\$19.2	\$22.1	\$24.1	\$25.3	\$27.2	\$27.2
% of GNP	0.6%	0.6%	0.5%	0.5%	0.5%	0.6%	0.6%	0.6%	0.6%	0.5%
Federal Aid Highways (Billion)	\$3.6	\$6.2	\$6.6	\$5.4	\$5.4	\$5.2	\$6.4	\$6.2	\$5.8	\$7.8
% of All Highways	20.6%	36.4%	41.8%	32.8%	28.0%	23.4%	26.5%	24.6%	21.5%	28.6%
Total Construction Aggregates (Mill. Tons)	1746.5	1562.6	1384	1516.7	1729.9	1800.9	1906.2	2096.3	2172.2	2110.7
Total Value F.O.B. Plant (Billion)	\$5.3	\$5.0	\$4.6	\$5.2	\$6.0	\$6.5	\$7.0	\$8.2	\$8.7	\$8.5
Total Crushed Stone (Mill. Tons)	983.5	872.6	790	861.6	956	1000.8	1023.2	1200.1	1247.8	1213.4
Total Value F.O.B. Plant (Billion)	\$3.3	\$3.1	\$2.9	\$3.3	\$3.8	\$4.1	\$4.3	\$5.2	\$5.6	\$5.3
Total Constr. Sand & Gravel (Mill. Tons)	763	690	594	655.1	773.9	800.1	883	896.2	924.4	897.3
Total Value F.O.B. Plant (Billion)	\$2.0	\$1.9	\$1.7	\$1.9	\$2.2	\$2.4	\$2.7	\$3.0	\$3.1	\$3.2
Source: Federal Highway Administration & U.S. Bureau of Mines.										

◀ **Figure 20 (facing page).** Topographic map of the bedrock surface, Kane County, Ill. Contour interval 25 ft; datum is mean sea level. Screened dashed line, municipal boundary. Modified from Vaiden, R.C., and Curry, B.B., 1990, Bedrock topography of Kane County (computer cartography by A.L. Erdmann): Illinois State Geological Survey Open File 1990-2b, scale 1:62,500.

usage factors of materials on Federal Aid Highway construction projects. The basic information for these statistics is provided by the contractors in reports entitled, "Statement of Materials and Labor Used by Contractors on Highway Construction Involving Federal Funds." The data include specifics on total costs of the projects and of the major components (total cost of materials and labor) and information on total quantities of materials used on the projects. According to the Federal Highway Administration, the annual costs ranged between \$15.7 billion in 1982 and \$27 billion in 1988 for construction projects on *all* Federal highways (table 2). This total represents about 0.6 percent of the Gross National Product. Of this total, between \$3.6 and \$7.8 billion were spent on Federal Aid Highway projects, about 20-28 percent of the total for all public highways. As reported to the U.S. Bureau of Mines, total value of the U.S. production of aggregates, FOB plant, for all the public roads was between \$4.6 billion in '82 and \$8.7 billion in '88.

The Federal Highway Administration collects data on projects larger than \$500,000 until 1988, and, beginning with 1989 on projects larger than \$1 million (table 3). Information about the distribution of major cost components of the Federal Aid Highway construction contracts is also available by State (tables 4-7). The distribution of the cost components by State is, in general, similar to that for total U.S. The Federal Highway information data indicate that of the three major components—labor, equipment and overhead, and materials put in place—the total cost of materials is the

major component, representing between 44 and 48 percent of the total construction costs of Federal Highway Aid construction contracts (table 3). The cost of aggregates put in place represents the major component among the materials, between 9.6 and 15 percent. The other major components are bitumens, steel, and cement. The information collected by the Federal Highway Administration is also used to generate highway construction material usage factors for the U.S. as well as for each State. These average usage factors indicate how much aggregate, cement, bitumen, steel, and other materials were used on federally funded projects over a 3-year period. The average usage factors are reported as quantities of materials per million dollar construction contract costs, and represent put-in-place cost. The latest Federal Highway Administration usage factors for 1988, '89, and '90 indicate that at the U.S. level an average of about 20,000-21,000 tons of aggregates were used for each million dollars spent on highway projects. At an average unit price of \$10 to \$15 per ton of delivered aggregate this represents a total of about \$200,000-\$315,000 per million spent, or 20-31.5 percent of the total cost of the project.

Some conclusions can be drawn from the analysis presented above. (1) The cost of put-in-place materials used on Federal Aid Highway construction projects is a major component of the total cost of the project. (2) The information collected by the Federal Highway Administration is not always consistent and depends on the contractor's interpretation and understanding of the reporting form; for example, there is an item on the form called "Length of the Project," that could provide very valuable information. Unfortunately, the mileage lengths reported under this item do not represent the actual length of the project, but are the sum of consecutive operations over all individual sections of the project, and thus are 3-5 times longer than the actual project. (3) Some of the data are collected as total values of the major

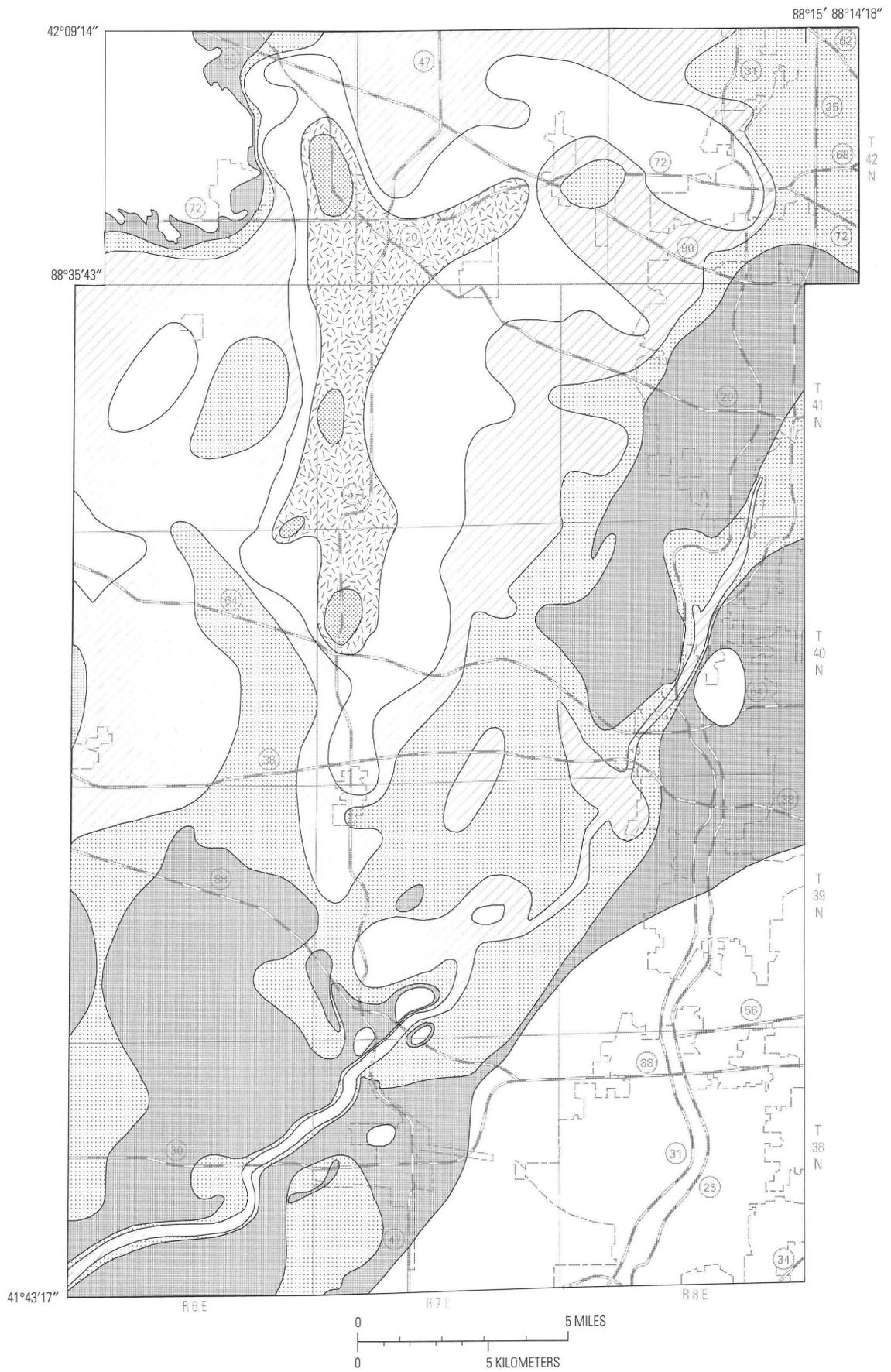


Table 3. Cost distribution, Federal Aid Highway construction contracts, all highways.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Aggregates	12.7%	12.6%	12.9%	11.1%	11.7%	12.3%	15.0%	11.5%	12.8%	9.6%
Portland Cement	6.2%	6.0%	5.2%	5.5%	3.5%	5.1%	5.2%	4.8%	5.2%	5.5%
Bitumens	6.5%	7.2%	7.7%	8.2%	8.5%	10.6%	11.2%	8.7%	9.1%	7.3%
Steel	8.6%	7.4%	8.0%	7.7%	7.7%	7.2%	5.3%	5.5%	4.8%	5.5%
Other	11.9%	11.1%	11.4%	12.6%	15.4%	12.0%	9.9%	17.7%	14.5%	16.4%
Total Materials Cost (Million)	\$1,652	\$2,734	\$2,966	\$2,450	\$2,509	\$2,439	\$2,968	\$3,001	\$2,713	\$3,449
as % of total construction cost	45.9%	44.3%	45.2%	45.1%	46.8%	47.2%	46.6%	48.2%	46.4%	44.3%
Total Labor (Million)	\$767	\$1,290	\$1,299	\$1,103	\$1,056	\$997	\$1,267	\$1,264	\$1,158	\$1,635
as % of total construction cost	21.3%	20.9%	19.8%	20.3%	19.7%	19.3%	19.9%	20.3%	19.8%	21.0%
Equip. & Overhead (Million)	\$1,180	\$2,148	\$2,296	\$1,880	\$1,796	\$1,731	\$2,134	\$1,961	\$1,976	\$2,701
as % of total construction cost	32.8%	34.8%	35.0%	34.6%	33.5%	33.5%	33.5%	31.5%	33.8%	34.7%
Total Construction Cost (Billion)	\$3,599	\$6,171	\$6,561	\$5,433	\$5,361	\$5,168	\$6,369	\$6,226	\$5,847	\$7,785

Source: Federal Highway Administration.

EXPLANATION

Tiskilwa Till Member, Wedron Formation
(Thickness in feet)

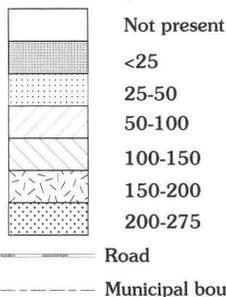


Figure 21 (above and facing page). Distribution and thickness of the Tiskilwa Till Member in Kane County, Ill. Modified from Curry, B.B., 1990, Distribution and thickness of the Tiskilwa Till in Kane County (computer cartography by A.L. Erdmann): Illinois State Geological Survey Open File 1990-2g, scale 1:62,500.

components, whereas other parts are collected as quantities only, with no unit or total value; that creates a problem when you try to analyze the information. (4) As a result of heavy development along most major highways and metropolitan areas, the shipping distances for aggregate are increasing. It should be expected that the costs of various materials will increase significantly in the future. Therefore, an increase in the total amount of funds allocated for infrastructure projects may produce a lower volume of final product than in the past. (5) And, finally, the States, in our opinion, should start implementing programs that would allow them to manage their natural resources more efficiently on a long-term basis and keep down the prices of basic materials like aggregate. The Surface Mining and Reclamation Act program implemented in California should be an example.

MATERIALS—A MAJOR COMPONENT OF THE INFRASTRUCTURE—II

Dr. Subhash B. Bhagwat, Mineral Economist, Illinois Geological Survey

Some of the problems that Val has encountered with this information on aggregate that he has collected from various agencies give us reason to look at some specific projects and to see if we can come up with a somewhat more precise estimate of what amount of material is used and what it is worth, both in absolute terms as well as in relation to the total cost, and try to put it in relation to the number of miles, if possible. We decided to take two different projects, one an inner-city project in the city of Urbana and another one, Route 51 between Bloomington-Normal and La Salle-Peru, which is about 70 miles long.

Figure 24 shows the city of Urbana project. The total length of the street that they are building (the Windsor Road in southern Urbana) is about 1.2 miles; the total cost of that project was about \$3.3 million. I am very grateful to the City Engineer, Mr. Balbir Kindra, for data on materials. About 9,000 cubic yards for aggregate trench fill and sub-base material, 11,000 cubic yards of Portland Cement and other cement and concrete, 600 cubic yards of bituminous concrete, and 412 tons of lime were used. The material was supplied from a quarry about 30 miles from Urbana. Because the contract terms always provide in-place dollar figures for calculation of transportation costs, we used tons/per cubic yard, standard conversion factors, and a formula that the Illinois Department of Transportation uses. Without going into the details of the calculations, let me just summarize that the cost per ton, FOB mine or quarry, was about \$4 a ton, or \$8 a cubic yard for stone, and \$6.80 per cubic yard for sand and

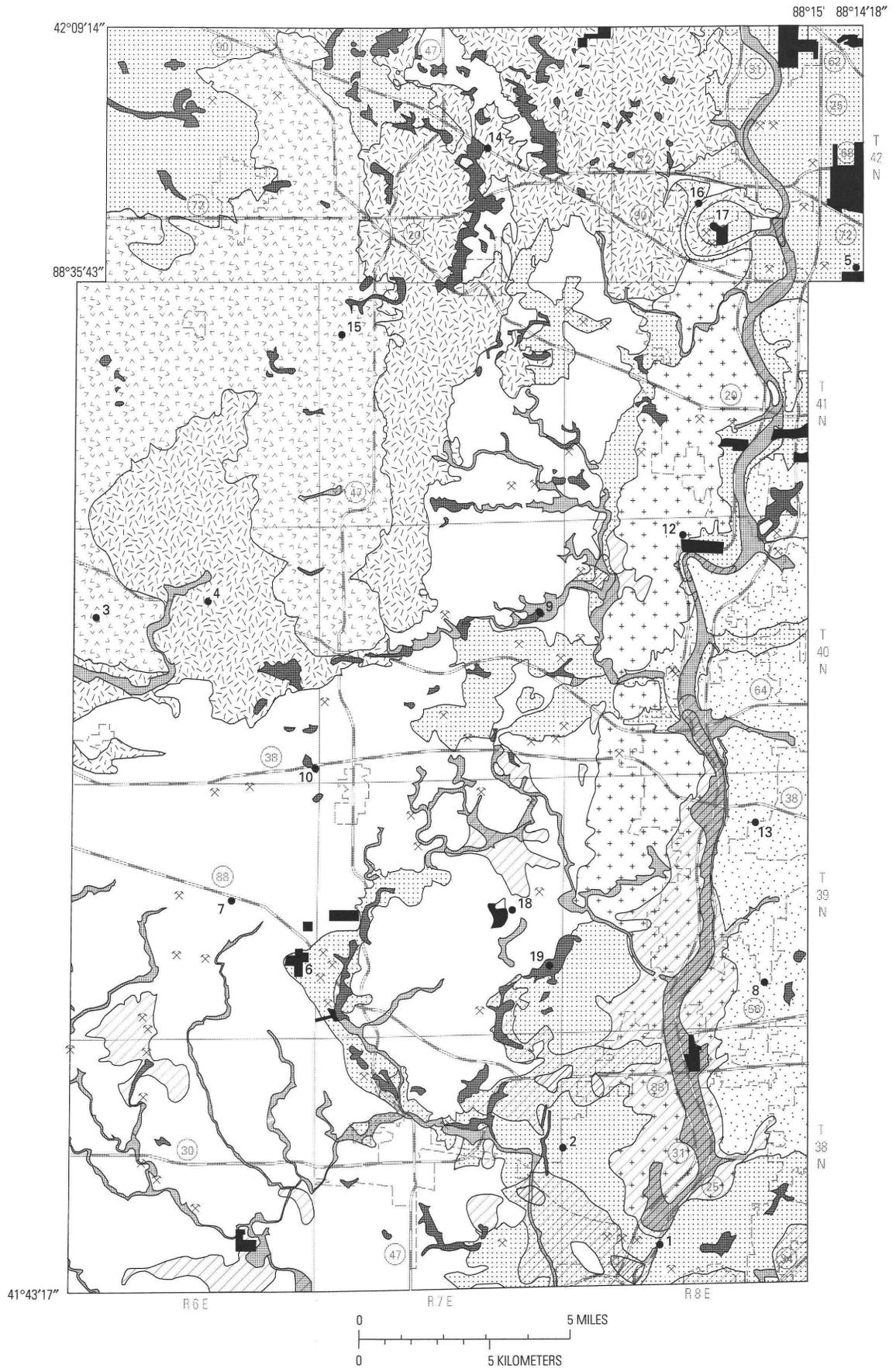


Table 4. Cost distribution, Federal Aid Highway construction contracts, Illinois.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total Materials Cost (Million)	\$140.8	\$204.4	\$174.8	\$145.6	\$124.4	\$120.8	\$153.6	\$183.4	\$174.9	\$236.2
as % of total construction cost	44.5%	46.7%	45.0%	48.7%	46.9%	46.3%	48.0%	45.3%	45.9%	46.2%
Labor (Million)	\$79.4	\$98.7	\$85.0	\$64.2	\$60.4	\$56.0	\$70.3	\$88.0	\$82.1	\$112.4
as % of total construction cost	25.1%	22.6%	21.9%	21.5%	22.8%	21.4%	22.0%	21.7%	21.5%	22.0%
Equip. & Overhead (Million)	\$96.2	\$134.2	\$129.0	\$88.9	\$80.6	\$84.3	\$96.3	\$133.3	\$124.3	\$162.2
as % of total construction cost	30.4%	30.7%	33.2%	29.8%	30.4%	32.3%	30.1%	32.9%	32.6%	31.8%
Total Construction Cost (Million)	\$316.4	\$437.3	\$388.8	\$298.7	\$265.4	\$261.1	\$320.2	\$404.7	\$381.3	\$510.8
Source: Federal Highway Administration.										

EXPLANATION

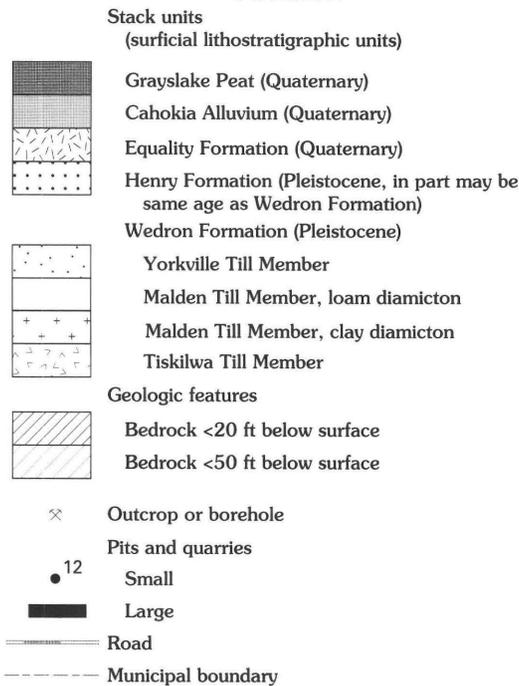


Figure 22 (above and facing page). Stack unit map (to 50 ft) of Kane County, Ill. Modified from Curry, B.B., 1990, Stack unit map (to 50') of Kane County (computer cartography by A.L. Erdmann): Illinois State Geological Survey Open File 1990-2i, scale 1:62,500.

gravel. Transportation costs for 30 miles distance varied around \$3.90 per ton (or \$7.80 per cubic yard) of stone. If we add that up together, the total cost of materials delivered at the construction site amounted to about \$300,000 or 9.2 percent of the total cost of construction, which fits pretty nicely into the range that Val presented.

Figure 25 summarizes the federally aided upgrading project of Route 51 which is 70 miles long. The details of the

36 contracts were provided to me by Mr. Paul Savio of the Illinois Department of Transportation's Region 3 offices. They add up to a total cost of \$200 million, for the entire stretch of 70 miles. The data were presented partially in cubic yards and partially in tons; they total about half a million cubic yards of sand, gravel, and crushed-stone-concrete type materials, plus another half a million tons of the same type of materials, and 45,000 tons of lime. There are a number of quarries in Livingston, La Salle, and Peoria Counties and dozens of pits, mostly to the west of the highway, all within 20 to 30 miles of the construction site. So we could use the same approximate figure of 30 miles of transportation as an average, and the same averages for FOB mine price of materials. Using those numbers, the total material and transportation accounted for \$11.7 million or just under 6 percent of the total construction cost.

These summaries of two specific cases seem to verify the conclusions from the aggregated data that Val was able to put together.

Timothy S. Hayes:

We turn now to Tim Haithcoat, who is a Program Director of the Geographic Resource Center of the University of Missouri, Columbia, for a discussion of environmental issues in the resource availability of the industrial minerals.

ENVIRONMENTAL ISSUES THAT AFFECT PRODUCTION AND CONSUMPTION OF INDUSTRIAL MINERALS

Timothy L. Haithcoat, Program Director, Geographic Resources Center, University of Missouri-Columbia

Environmental issues and resource availability. We have three panels set up for this afternoon that are covering

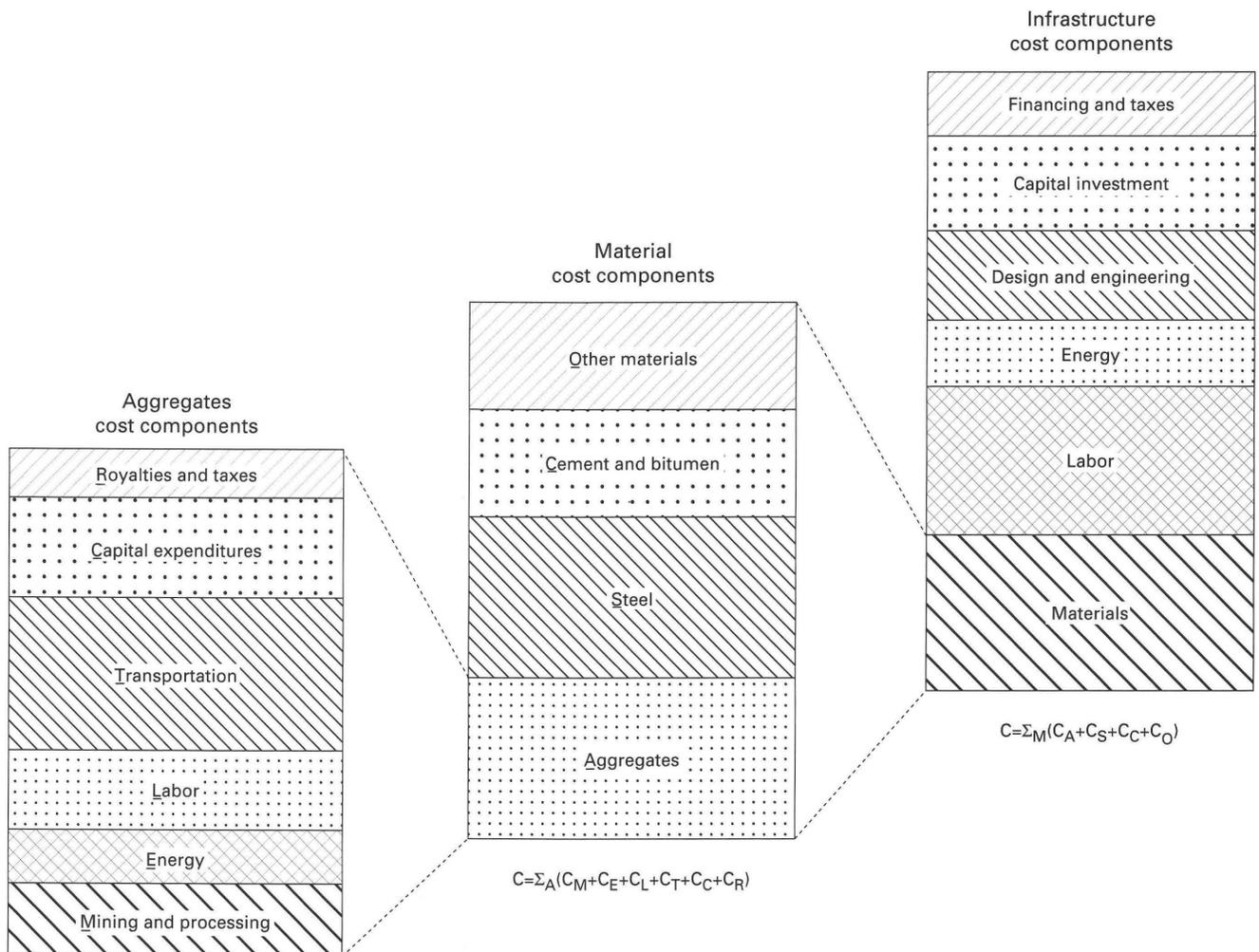


Figure 23. Cost of materials as a part of infrastructure costs.

information essential to resource availability, environmentally responsible production, and the environmental costs of ignoring resource data. All these sessions overlap significantly with the topic of environmental issues in resource availability, which is the proposed topic for my discussion.

The environmental issue I am about to address, however, may not fall directly into the realm of resource availability as you perceive it. I hope to broaden your perspective of environmental issues. What I want to cover within the scope of this talk is what I feel is the basic driving force behind how accessible these minerals are going to be to your industry in the future. The viewpoint I'll be taking will become clear in a moment.

When you think of accessibility, you think of such variables as resource location, possible extraction processes, availability of transportation, etc. You think about the tangibles, the logistics. What I want to do, though, is argue that the most important environmental issue facing this industry is the public's changing attitude regarding environmental issues. The mineral industry, as well as many other industries

that are involved in altering the environment, is going to be trying to understand and deal with these perceptual changes. How do people perceive the environment around them? How do people perceive your industry or business?

How have and how will these two perceptions combine to influence the industrial mineral industry? What are their potential impacts and benefits? To examine these issues we must first look at two different processes that are currently underway in the United States. The first one is the current state of what we'll call the urban form. The cities and metropolises that we see today are a product of past processes of population and economic growth and their associated concentration into these entities called cities. These cities have since become established due in a large portion to the industrial minerals supplying the growth and construction of these cities. Your industry was set up around the periphery to service those growing needs. The cities grew and became organized as core centers or core-oriented urban areas. This is where the idea of a central business district originated. This growth of the city promoted growth of

Table 5. Cost distribution, Federal Aid Highway construction contracts, Kentucky.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total Materials Cost (Million)	\$36.8	\$51.8	\$72.8	\$33.5	\$131.4	\$21.7	\$38.9	\$46.3	\$71.9	\$28.7
as % of total construction cost	52.1%	59.0%	51.4%	42.1%	49.4%	52.5%	52.2%	45.5%	60.6%	46.9%
Labor (Million)	\$16.2	\$13.3	\$31.3	\$19.4	\$51.2	\$8.9	\$14.1	\$23.8	\$17.3	\$17.4
as % of total construction cost	22.9%	15.1%	22.1%	24.4%	19.2%	21.5%	18.9%	23.4%	14.6%	28.4%
Equip. & Overhead (Million)	\$17.7	\$22.7	\$37.5	\$26.7	\$83.6	\$10.7	\$21.5	\$31.6	\$29.4	\$15.1
as % of total construction cost	25.0%	25.9%	26.5%	33.5%	31.4%	25.9%	28.9%	31.1%	24.8%	24.7%
Total Construction Cost (Million)	\$70.7	\$87.8	\$141.6	\$79.6	\$266.2	\$41.3	\$74.5	\$101.7	\$118.6	\$61.2

Source: Federal Highway Administration.

City of Urbana
Federal Aid Highway
Windsor Road

Length=1.184 miles
Total cost=3.28 million dollars

Materials consumed:

Trench backfill, sub-base granular material, shoulder aggregate, etc. 9,000 yd³
Portland Cement and cement concrete 11,000 yd³
Bituminous concrete 600 tons
Lime 412 tons

Source of aggregate materials:

Fairmont quarry, Vermilion County, 30 miles SE. of Urbana

Estimated price FOB:

\$ 4.00/ton or \$ 6.80/yd³ (S&G), \$ 8.00/yd³ (Stone)*
*Higher prices for concrete not included

Estimated transportation cost:

\$ 3.90/ton or \$ 6.60/yd³ (S&G), \$ 7.80/yd³ (Stone)
for 30 nonurban miles

Material and transportation account for about \$ 300,000 or 9.2 percent of project cost.

Acknowledgment: Mr. Balbir S. Kindra, City Engineer, Urbana, IL.

Figure 24. Materials and transportation data, City of Urbana, Champaign County, Ill., project.

concentric rings of socio-economic development around this central core. What you see happening today, however, is quite different from anything we have seen in the past. In the last two to three decades, people have had more money. They have more real income to spend. The transportation network and the transportation technologies are such that they can move around a lot more. Accompanying these

Route 51--Federally Aided Upgrading
Bloomington/Normal to LaSalle/Peru

Length=70 miles
Total cost from 36 counties=about \$ 200 million

Materials consumed:

Sand, gravel and like materials 50,000 yd³ + 200,000 tons
Crushed stone, concrete etc. 450,600 yd³ + 330,000 tons
Lime 45,000 tons

Source of aggregate materials:

15 quarries in Livingston, LaSalle, and Peoria Counties
Dozens of pits mostly west of highway
All within 20-30 miles from site

Estimated price FOB:

\$ 4.00/ton or \$ 6.80/yd³ (S&G), \$ 8.00/yd³ (Stone)*
*Higher prices for concrete not included

Estimated transportation cost:

\$ 3.90/ton or \$ 6.60/yd³ (S&G), \$ 7.80/yd³ (Stone)
for 30 nonurban miles

Material and transportation account for about \$ 11.7 million or 5.85 percent of project cost.

Acknowledgment: Mr. Paul Savio, Illinois Dept. Transportation, Region 3.

Figure 25. Materials and transportation data, Route 51 upgrade project, McLean, Woodford, and La Salle Counties, Ill.

factors is an increase in subsidized suburban housing. Not surprisingly, the people responded. Rural people moved into the city, or in towards the city. They started working two jobs, the farm job and a city job. You had the upper income people, who were in close to the city for convenience, moving out of the city's core and into the periphery. This is the current phase of urban sprawl that many communities are

Table 6. Cost distribution, Federal Aid Highway construction contracts, Missouri.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total Materials Cost (Million)	\$58.6	\$87.6	\$94.8	\$87.6	\$79.4	\$95.4	\$105.6	\$111.0	\$67.1	\$80.4
as % of total	51.4%	46.1%	52.1%	58.7%	48.7%	47.2%	44.7%	44.5%	45.8%	48.0%
Labor (Million)	\$28.0	\$39.5	\$46.6	\$32.0	\$35.1	\$49.7	\$56.0	\$56.6	\$32.5	\$36.1
as % of total	24.6%	20.8%	25.6%	21.4%	21.5%	24.6%	23.7%	22.7%	22.2%	21.6%
Equip. & Overhead (Million)	\$27.5	\$63.0	\$40.5	\$29.6	\$48.6	\$57.0	\$74.7	\$82.1	\$46.9	\$50.9
as % of total	24.1%	33.1%	22.3%	19.8%	29.8%	28.2%	31.6%	32.9%	32.0%	30.4%
Total Construction Cost (Million)	\$114.1	\$190.1	\$181.9	\$149.2	\$163.1	\$202.1	\$236.3	\$249.7	\$146.5	\$167.4

Source: Federal Highway Administration.

Table 7. Cost distribution, Federal Aid Highway construction contracts, Tennessee.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total Materials Cost (Million)	\$47.5	\$106.3	\$78.7	\$75.6	\$71.1	\$93.2	\$97.7	\$79.2	\$64.5	\$87.0
as % of total construction cost	50.4%	46.1%	51.0%	60.9%	59.5%	55.9%	62.6%	59.9%	62.9%	50.3%
Labor (Million)	\$12.5	\$29.6	\$21.5	\$17.2	\$14.6	\$18.2	\$18.8	\$17.9	\$14.5	\$25.6
as % of total construction cost	13.3%	12.8%	13.9%	13.9%	12.2%	10.9%	12.0%	13.5%	14.1%	14.8%
Equip. & Overhead (Million)	\$34.2	\$94.6	\$54.1	\$31.3	\$33.8	\$55.4	\$39.6	\$35.2	\$23.6	\$60.4
as % of total construction cost	36.3%	41.0%	35.1%	25.2%	28.3%	33.2%	25.4%	26.6%	23.0%	34.9%
Total Construction Cost (Million)	\$94.2	\$230.5	\$154.3	\$124.1	\$119.5	\$166.8	\$156.1	\$132.3	\$102.6	\$173.0

Source: Federal Highway Administration.

trying to catch up with and manage. Look at St. Charles [Missouri] and the problems that the St. Charles County Planning Department has trying to keep up with the flow of people and service industries out of sprawling St. Louis. So what's the problem? They are moving into and around the areas encompassed by your industry. You have to "share" their space. These people that are moving into these areas now are more affluent, more educated, and much more ecologically oriented than they have ever been in the past. These people are coming and buying land and building houses right on your doorstep. The problem is you, as an industry, cannot just pick up and move a quarry very easily. The latitude to site a new economically feasible quarry or expand an existing site is becoming very limited.

Why is it becoming so difficult? The reason as I see it is the change in people's perception of the environment. I am going to continue this line of thought based on the premise that people as a whole now care about the quality of their environment, especially the environment that immediately surrounds them. When they perceive that it has degraded and it is affecting them personally they will act on it. The immediate question is how long does it take for them to reach this point? What is their perception of bad? This critical point, and its location, has been constantly changing through time. To put this into perspective let me toss out an idea first composed by Aldo Leopold, the father of modern

wildlife management and conservation. He came up with three ethics related to the development of human thought and their perceived needs. These ethics were successional in that they needed to be fulfilled in order. The first ethic is basically man-to-man ethics. These relationships were defined through religion with their impact being a stated morality for man to follow. The second ethic was man's relationship to society. That was defined by the democracy under which we now live. The third and final ethic in the successional series, was the development of a land ethic—man's relationship to the environment. I think we can all agree that the first two stages have arrived. The next one to come is the development of a land ethic.

Is it possible? Let's examine just a few of the activities that are now surrounding us. Look at the environmental movement, the number of environmental groups being formed, the "activists" and their activities. They are having a huge media impact and are greatly transforming how the average person views an industry. Look at Earth Day and the big media and political push behind this event. Look at all the conservation measures being passed at the local, State, and Federal level. All of these activities are combining to form a general ecological attitude that has not been seen before. The final outcome of this development is not something that any one of us can foresee, but it will be there!

So where am I going with all of this? The solution to these types of environmental problems and issues isn't just physical compliance. I do not feel you can afford the attitude of, "Well, we are meeting these standards—thus we are okay." People are now evaluating your industry, as well as many other industries, as it pertains to their perceived cultural satisfaction. You, as an industry, will need to make yourselves aware of this new generation's concept of need. In the past, industry standards were set via research related to potential physical illness or toxicity limits to man or other organisms. What we see today is a very real potential for aspects such as social, psychological, cultural, and esthetics to become involved in these standards. This may not occur at the national level. As a matter of fact it probably won't, but it can very easily be legislated at the county or local level wherein your business operates. This potential lies in the fact that again people have more money and have come to expect certain things. Granted, most citizens do not become involved in issues or decisions made by local planners, etc., and are not accustomed to thinking about these types of things. However, this can change, and it usually does when one of two things happens. First, if it is in their "backyard," then they become activists overnight. The second, however, is more subtle: when people are going through their daily activities and things just start to pile-up. They see increases in taxes. They see increases in schoolroom class sizes. They see slow-downs at truck entrances. All these things then combine with the new ecological attitude and they start to wonder, "Where's the payoff?" and, "Why should I have to put up with these things?" It then takes only one person to start the ball rolling when he or she decides that it doesn't have to be that way, that they can make a difference or cause change. That is when city and local councils start to be petitioned and it rolls on from there.

So where does that leave us? Well, people everywhere have similar biological, psychological, and social needs. Many of the norms and values that man has developed in order to satisfy these needs are cross-cultural. The ecological attitude, this land ethic, requires nothing new in terms of moral principles. What it does require is your realizing how your business, and this industry, are being viewed by the general public, your new neighbors. You need a more sophisticated look at how you are impacting, or are perceived as impacting, the surrounding environment. The burden of proof will fall on you to convince this new generation of the ecological soundness and economic importance of your business and this industry. You just can't go on basic economics anymore. I think the talk tonight at the banquet, "If only Dick and Jane had gone to the mines," will bring up a very important point, and that is education. You must educate the populace about what you do, what controlling factors you have, what regulations must be met, and possibly what you're currently doing beyond those regulations. These types of activities will make for longevity of your business and industry in a time and realm where the impact

of environmentalists and environmentalism is going to be rapidly growing. The challenge before you is in the creation and distribution of ecologically oriented material on your industry, educating the children of today and their parents as to what you do and how it is accomplished, and most importantly, becoming more pro-active with this more environmentally oriented populace. The ball is in your court—it's your move.

Timothy S. Hayes:

That was a very broad and interesting view. At this point, we want to turn from the attempt to identify the issues and ask what the state of the mineral industry is in the Mid-continent. For this we have asked Mr. Dudley Blancke, Consultant in Mining and Public Affairs in Hot Springs, Arkansas, to briefly discuss the industry in this area.

OVERVIEW OF THE STATUS OF THE INDUSTRIAL MINERALS INDUSTRY

C. Dudley Blancke, Consultant, Hot Springs, Arkansas

I was asked to give an overview of the industrial mineral industry and its problems. I feel like the TV commentator that goes on after a speech by President Bush to tell us what the President really meant. I think the previous speakers made their points very clearly and you all understood them. I also believe the industrial minerals industry is holding up very well and as the recession slowly recovers this industry will improve.

I notice that about 80 percent of this group is made up of government regulators; I really expected a lot more operators to be present. In the nation of Haiti there is a proverb, "The cockroach seldom goes to the party thrown by the chickens." In that light I can understand the lack of operators. I was fortunate to have worked in Haiti, and one of the problems was that English was not the spoken language. When I had to discipline someone, I had to use an interpreter. After one session where I had been particularly vocal and angry, the interpreter said, "Boss, that was the best you ever did, I didn't have to add anything this time!" I wonder now what I had been saying the other times. Most of us that are not with the government find it difficult interpreting the language used to write regulations and to determine what was meant by a phrase, or the intent of it. We are obliged to hire interpreters to read them for us. In the Ashanti-Twee language in Ghana, there is a word, "medewase oooo," which means, "Thank you for a very special favor"; they have another word that, to me, sounds exactly the same but means, "Be careful, I'm underneath you." You can see how this might cause a problem. One must be very careful in interpretation and that certainly includes government regulations.

I disagree with some definitions of the oldest profession. I believe mining is the oldest profession. The first time man selectively picked up a rock to use as a tool he was mining, the first time he grabbed a handful of clay to make a pot, he was mining. Today we're making a lot more tools and many more pots but we only employ about 3 percent of the work force and we're not a controlling factor in the gross national product. But without mining, there is nothing. Can you imagine a world without tools? You can't even pick up a rock to sharpen a stick. There are only two basic industries, mining and agriculture; lose one and we return to a nomadic existence.

The many problems of our industry can be put in two categories, internal and external. We are trained to handle the internal problems, troublesome employees, weather conditions, equipment breakdowns, etc. The external problems that I will discuss are environmental, real estate development, news media, and political. They are all interrelated, and you cannot separate one to work on without taking the others into consideration.

The top 10 environmental groups operating in this country have a budget of over \$250 million, and most of it goes to lobbying. Rest assured, with money like that they're not going to go away. One of the environmental groups says we must stop all highway repair and construction so that industry will slow down, which will slow down pollution. Stephany Mills wrote in her book, "Whatever Happened to Ecology?", published by the Sierra Club in 1989, "I wonder what we will substitute for different things when the trucks stop running." It's scary. There was one group that objected to a project because it destroyed the mood-producing qualities of the area. Thank goodness they lost that one.

The local groups, that you normally must deal with, receive their information from the national groups and truly believe that every word is gospel. These local groups are our neighbors and they are sincere in what they're trying to do. You cannot ignore them, and you sure don't want to get into a knock-down fight with them, because that's what the press loves—and I guarantee that you will come out on the short end. You have to work with them, talk to them, anticipate their thrust and disarm them, get a friend to join the group. Don't wait for them to hold a public forum, you call it. Don't wait for them to speak, you speak first. You set the stage, you pick the topics. If they speak first they will air a laundry list of factoids that you will be obliged to answer. When you speak first they must address your information. If you call the public forum, it looks better. It shows you have nothing to hide and that you're not afraid of what they have to say. Tell them everything you possibly can. In that way if there is a little information you would rather not make public at the time, it is not noticeable. Come out as soon as you can with news, good or bad, it looks better than if the group has to force the news out. Eventually people will start believing in you.

Sometimes you can invite them to visit your operation. If you can, invite them to help with a particular problem, talk to them on a one-to-one basis, no press. In this way they may realize that some of your problems are very difficult to overcome and they may be willing to make concessions. You should join some pro-industry environmental groups like the National Council for Environmental Balance or Consumer Alert. You not only get great information but you feel good knowing there are people on your side.

Real estate development, that's a difficult problem. I think land-use planning is the answer, but it's sure not easy to sell. Go down to the backwoods of Arkansas and tell that old man that he can't do with his land what he wants to. You better be ready to move because he sure isn't happy. Politics plays a big part in this, both in land-use planning and big developments. On a small scale you can usually work things out by personal contacts. If a big development tries coming in, the sooner you get on it the better. Although the minerals industry is large, it is made up of many small units, and these small parts don't have the clout of the Union Carbides and the Anacondas. That's why you don't hear about the land that is being taken away from the industrial minerals mining industry by urban sprawl. The press covers the land taken for wilderness areas and other large areas, but nothing is said about our loss that forces us further from the market place.

The news media, now there's a case. On national TV you see "20-20" and "Sixty Minutes" telling us how and where to mine, how to build power plants, how to clean chickens, and how to do everything. The Haitians have another saying about people like that: "Even though a goat's droppings resemble pills, that does not make the goat a pharmacist." These TV programs are full of factoids that the general public take as facts. The same thing happens in the print media. You must lobby the news media just as you do the politicians. Get to know the reporters on a first-name basis, feed them information, give them advance information, get them to the point that when an environmental group gives them a story, they call you to get your side. This will put both stories together. Usually you read the environmental side on the front page and by the time you get back, it's on the back page if in at all. We started a group in Arkansas called Friends of Industry and Technology. We have no dues, no newsletters, and very informal meetings, but it does give us a forum in the news media. One important thing to remember is, don't get crossways with the media. You may not get them as supporters but at least try to keep them neutral. Remember a reporter is a lot like a computer, the only information they know is what's fed to them.

The last and certainly not the least is the political arena. Although we do pay a lot of taxes, I believe we're getting more government than we're paying for—for sure more than we need or want. The politicians are the ones that do most of the regulations, through government agencies, because they are very sensitive to the media and the public. Unfortunately

the public is being educated by the media and most of the media has an obvious bias. A good lobbyist is more a teacher and bearer of information than he is an applier of pressure tactics, although that is important also. Too many times the regulations are overly restrictive, like those on asbestos. Regulations are in place now and will be expanded to all mines that contain any fibrous mineral, even though there is not clinical evidence that they are harmful to man. Unfortunately the regulations will be put into law even if proven that most fibrous minerals are not harmful. The EPA says that any fiber with a ratio of more than 3 in. length to 1 in. in diameter will be included; anything smaller than that must be a fiber having only two ends. You will have to sample your pit and if any fibrous material is present, you will have to take special precautions with your employees and the public. It has been shown that dioxin is not as toxic as once believed, and the Center for Disease Control has said that the people in Times Beach should never have been moved out. The Center has said that the risk from dioxin by living in Times Beach is the same as drinking one beer in a lifetime. Yet the government is going on with the billion dollar project of returning Times Beach to a pristine environment. The EPA has admitted that the banning of DDT was political and not based on technical information. Unfortunately facts and technology don't enter into government regulations.

Radiation is another problem about to surface, even though there is no evidence that low levels of radiation are harmful to the public. The parking lots around Danville, Virginia, put out more radiation than is allowed from a nuclear power plant. This is from the radioactivity contained in the aggregate. I anticipate required testing and restrictions on all mines for radiation. Now add a health physicist to your staff. Heavy metals will probably be another contaminant you will have to deal with.

I've come to the conclusion that things aren't dangerous until they're regulated. The risk from many of these contaminants are taken from a linear graph. It is known how much of a material is harmful to a human, it is assumed that a zero amount would be harmless. A line is drawn from the high to zero and the risk is measured from this line. This is the same as saying that if two hundred aspirin will kill a man, then if two hundred men each eat one aspirin one man will die. The politicians react to this because the press has trained the public to react to it. You have to help the politicians. Feed them facts, feed them positive information on the results of their acts, be willing to compromise and give the politicians a way to save face, make a trade-off offer to help them on a different project if they help you. If you can support them, do so. If you can't, try not to oppose them publicly unless you have no choice.

Our biggest failure has been in the education of the public. I gave a talk to a Wildlife Federation group, and during the question period one person mentioned that it was a shame that mining ruined so much land. I mentioned we didn't ruin

it, we just changed it, and we didn't change as much as airports do. This person then said, "Yes, but we need airports!" I spoke to a group of sixth graders at an environmental camp—my talk was labeled, "Why we need mining." One of the teachers said, "I wouldn't want to miss this, I'd like somebody to show me why we need mining." This is one of the people educating our kids. We can talk to each other all day but we must get our message out to the people. The public receives most of their information from television, followed by the newspapers and magazines. It's not just the "Sixty Minutes" and the "20-20's"; whenever you see a mine on TV it's dark, dirty, and dangerous. In Arkansas we have many beautiful lakes and of course a few people drown each year. They are reported on page two or three, but when someone drowns in an old mine pit the front page reads, "Youth drowns in old abandoned mine." It is up to us to make the changes.

The best way to do this is get acquainted with the educators, bring them with their students for a field trip. Go to the schools and give programs. Support the school programs that lean to our industry. We must convince the public how important our industry is to the infrastructure, to our standard of living, and to our quality of life.

PANEL SESSIONS—DAY 1

Monday afternoon, September 16, 1991

Timothy S. Hayes:

This afternoon's panel discussions are intended to elicit a lot of discussion from all of the people here in the Workshop. The first panel discussion returns to the subject of resource identification and evaluation; the panel leader is Lyn Bourne, a geologic consultant from Michigan.

RESOURCE IDENTIFICATION AND EVALUATION

Panel leader:

H. Lyn Bourne, Consulting Geologist, Northville, Michigan.

Panel members:

J. James Eidel, Branch Chief for Mineral Resources and Engineering, and Principal Geologist at the Illinois State Geological Survey.

Ira R. Satterfield, Director of the Geological Survey Program for Missouri, Division of Geology and Land Survey, Department of Natural Resources, Rolla, Missouri.

William M. Sheftick, Chief Geologist for Aggregates, Illinois Department of Transportation, Springfield, Illinois.

Zareh Mozian, Assistant Branch Chief in the Branch of Industrial Minerals, U.S. Bureau of Mines, Washington, D.C.

PANEL PRESENTATIONS

H. Lyn Bourne:

My name is Lyn Bourne, that's short for Lynwood. I specialize in industrial minerals and I've worked quite extensively with construction raw materials.

Development of new industrial mineral deposits and the continuation of current mining operations require many kinds of information. The information may be available from local, State, or Federal agencies. The following list gives some of the kinds of data that are needed by those who participate in the exploration for and the production of industrial minerals. The list is not prioritized because to do so implies that some information is less important. Depending on which hat you wear and where you sit, some items may have less importance.

Information Essential to Resource Availability

- Topographic maps. These are invaluable as they show most of the surface features, both natural and man-made. The 7½-minute quadrangles offer more detail than the 15-minute variety and are preferred. Most States have pretty fair topographic map coverage and these maps are pretty basic for any kind of resource evaluation. [Editors' Note: In 1992 the U.S. Geological Survey completed coverage of the conterminous United States with the 7½-minute scale topographic maps.]

- Geologic maps. These often illustrate bedrock formations and (or) surface formations plus structural geologic features. Sometimes they are available at the same scale as the 7½-minute quadrangle maps, but more often only as State geologic maps. In June of 1991 Dr. Mankin addressed the national need for geologic mapping in an AIPG article and pointed out that the United States is one of the least well mapped countries of the industrialized nations, ranging from Kentucky with 100 percent coverage of geologic mapping at a 7½-minute scale, to virtually zero for some other States. These are pretty critical kinds of information for planning resource availability. In the summer issue of *Outlook* [1991], Eva Kisvarsanyi provided a synopsis of an SEG (Society of Economic Geologists) questionnaire that dealt with the national status and problems of geologic mapping; it paints a pretty bleak picture for geologic mapping, from the standpoints of both funding and staffing. There just aren't very many qualified mappers, nor are the schools turning out the kinds of students who are capable of doing this.

- List of operations. Most State geological surveys publish, annually, a list of current mining operations. The information is usually organized by commodity and county. The publication should give the name of the producer, their address, the location of the operation, the geologic formation(s) quarried or mined, and a general description of the products from that location.

- List of geologic theses and dissertations. A few State geological surveys publish a list of theses and dissertations that deal with geologic questions and research that have been carried out within the State. Such lists provide the author's name, year of the work, sponsoring university, and title of the work. Sometimes these are arranged alphabetically, chronologically, or topically. Often there are schools outside of the State that have students working on research projects within the State. It's important that the State Survey put together this kind of a reference list so that all the work and research that have been done within the State can be tabulated. Such a list serves to give recognition to the authors and often provides reference to information that is otherwise unpublished.

- Transportation maps. Transportation is critical to industrial minerals because transportation costs often exceed (even doubling or tripling) the FOB cost of the material at the mine or quarry. Some States and counties publish base maps which show the rail and highway networks. Such maps are key pieces of information for evaluating potential sources and resources.

- Physical and chemical data. Potential deposits of industrial minerals are evaluated on the basis of their physical or chemical properties, some on both. Often the State geological survey and (or) the State highway department routinely keep records on the physical properties and the quality of the various aggregate materials that are available within the State, for example the high-friction aggregate material where asphalt paving is common, or the durability characteristics of materials as they behave either in asphaltic pavement or in Portland Cement concrete. These physical properties are very important for assessing and exploring for new deposits. Chemical data usually come from the State geological survey and are an important exploration tool. There's no point in looking at a deposit that's recognized as having an inferior quality. We have enough problems with our highways and local arterial roadways, without searching for, or not having access to, the information on which geologic materials offer the best characteristics.

- Specifications. Most of the published specification data relate to physical properties needed to satisfy the construction raw materials needs of the State or county. Chemical specifications vary from user to user, and published data usually give only general information. There may be specification changes for raw materials either because something has been depleted and is no longer available or new research has shown that there are better characteristics to look for; this has been especially true in high-friction aggregates or skid-resistant materials for wearing courses and asphalt pavement.

- Plat maps. These are the maps that show property ownership and size of parcel, usually on a township-by-township basis. They give an overview of land status within the county. Most plat books devote an 8½×11 in. page for the ownership within each township. If you are

trying to identify potential deposits within a geologic target area, it is very convenient to know the distribution of parcel sizes. [Editors' Note: Township plats generally are kept by the county Registrar of Deeds.]

- Land-use and zoning maps. If such maps are available, they are at the local or county level. In today's competition for land use, it is important for a prospective mineral producer to learn the current and proposed land use as it relates to property underlain by a potential new source. The maps which illustrated Kane County, Illinois, are outstanding. There are so many, many counties that may not have the resources to publish something that elaborate, but almost all counties or townships will have some kind of a zoning plan that will have an impact and a bearing on the availability of the geologic resources within that political sector.

- Permit requirements. Local, State, and sometimes Federal agencies have the authority to issue permits that affect a mining operation. Most States have information available that describes the requirements needed to obtain a mining permit, or that lists the statutes that may affect an operation. It is also important to find out if there are local regulations which must be met. It is not always easy to identify the local, State, and Federal permits that are necessary either to sustain an ongoing operation or certainly to open a new operation. I think it would be very worthwhile if there was some kind of clearinghouse within each State where you would be able to have access to the kinds of requirements that you would have to satisfy.

- Data base. Two of the first questions to answer are what information is available and where it is to be found. Some State geological surveys have begun to organize much of the information listed here on a computerized data base. Such a data base enhances the exploration for new deposits by hastening the search for information and offering a more comprehensive initial search.

- Commodity reports. Most of the things I've talked about so far are things that are available at State or local level. Commodity reports are annual Federal reports that give a bird's eye view of the supply and demand factors for the various industrial mineral commodities. These reports relate State and local trends to national patterns and are invaluable for that reason.

One of the things that I thought of since I printed the outline is demographic data. This might be something that could be handled in the data base. Knowing where the population shifts are going allows someone to anticipate where the aggregate materials are going to be needed, and where the greatest degree of competition for land use is going to take place. Knowing where to find information on changes in demographics is pretty important, whether the data are hard counts like the 1980 census, or whether they are an estimate that was done at the Federal level or the State level. Some of the research that may go on at a State highway level certainly was available in the Federal or the State geological bureaus as it relates to any of the industrial minerals

commodities, but we are focusing mainly on construction raw materials here. It's important to know what the latest information is on these things.

These are some of the kinds of information that are required to sustain resource availability, but there are two other conditions necessary for future success—media awareness and public acceptance. Many industrial minerals, especially construction raw materials, come from surface mining operations (pits and quarries) located near urban centers. The public takes for granted the supply of industrial minerals necessary on a day-to-day basis to sustain their lifestyle. However, they oppose (often vigorously) any new operations. We need to make the media more aware of the issues and bring them to the attention of the public. There are a number of examples of informed people who could offer insight for the media. At the Workshop held in California in 1989 (USGS Bulletin 1958), Hal McVey presented a scenario which illustrated how people in industrialized societies depend on industrial minerals. He talked about how each of us is in contact with industrial minerals on a daily basis, almost minute-by-minute and hour-by-hour. He cited products and processes which require industrial minerals, such as glass, paper, ceramics, carpet, toothpaste, talcum, water filtration, asphalt, concrete, recreation products, salt, medicines, etc. Dr. Colin Bristow, who used to be with English China Clays and has recently moved on to teaching in Cambridge School of Mines, wrote an interesting article in *Industrial Minerals* in February 1987, entitled, "Society's changing requirements for primary raw materials," in which he discusses the role of industrial minerals in the economy and the need to identify market trends. He discusses the same kinds of concepts that Hal McVey refers to. These are the kinds of people, along with most of us here, who can contact and talk to the media. The Society for Mining, Metallurgy, and Exploration, SME, recently formed a new corporation, the Foundation for Public Information and Education. Their goal is to have the membership become informed to disseminate information about the mining industry through the membership, to take an active role in educating the public (children and adults), provide the public and the media with factual data about the value of not just industrial minerals but of the mining industry in general.

J. James Eidel:

I'll attempt to "fine-tune" the outline that Lyn provided. *Historical information:* Don Mikulic at the Illinois Survey has put together a list with locations of some 250 quarries in the Chicago suburbs that is proving useful. Brud Leighton referred to a company that came to the Illinois State Geological Survey (ISGS) that was involved in a purchase of an industrial materials property in the Chicago area. The historical data available provided the knowledge that a large portion of the property had already been mined. It is important to know where abandoned and filled quarries are, both for

purposes of determining what has been used to fill them and to establish site characteristics for construction and engineering purposes, if facilities are to be constructed over old quarries. *Sample libraries:* A number of the State surveys also have major geological samples libraries, in addition to the physical and chemical data that are cataloged and described in print. These are physical rock sample libraries. The Illinois Survey has tens of thousands of oil and gas wells that are represented by almost 500 million feet of cuttings and close to a million feet of core from past mining operations. There is a good deal of rock in the box, so to speak, that can be referred to. A great deal of information can be derived in various areas by studying cores and cuttings. *Log libraries:* Paper records for past wells in States vary, but there are not only geophysical logs for a large number of holes, but also heading data and descriptive data for water wells, as well as oil and mineral tests. At the Illinois Survey there are some 313,000 well records, including a good deal of the water-well information that may be required for environmental assessment purposes. *Regulatory data:* When Tim Hayes introduced the Workshop and mentioned the USGS bulletin that would result from this Workshop, he indicated that there would be an appendix from each State describing the regulatory information that would be available from that State. I would like to add to that a suggestion that there also be a flow diagram for each State that illustrates the permitting process, the permits that are required, the agencies that are involved, maybe even the time that might be required to obtain those permits. [Editors' Note: Such information is included in the Appendices of this volume.] The list of statutes that Lyn referred to could include a list of all statutes that affect industrial mineral mining. The list could include reclamation laws and tax laws.

The items that Lyn just went through can be placed in two categories: the first includes topography, geology, demographics, transportation routes, location of quarries, physical and chemical parameters, ownership use and land planning; all can be part of a data base handled by Geographic Information Systems (GIS). Each one of those layers of data can be envisioned as a transparent map. Putting one on top of each other, you can envision building up a map layer by layer. The information that is required to assess a property in any given area can be assembled. This is what the Geographic Information System does by computer. It enables you to compare large amounts of data in a way that otherwise would be physically difficult or impossible. That is the route we're going at ISGS. Others are doing the same, providing that data first on-line in-house and then on-line to operators in the field.

The second category of information cannot be provided as a part of a GIS. These data include bibliographies and similar information in text form.

Finally, I would like to point out that the idea of educating the public is appealing and necessary. Education is not just the responsibility of the mining companies. Mineral

education is also the responsibility of the government agencies. The Shawnee National Forest, in southern Illinois, for example, has pamphlets on timber, recreation uses, and ATV's. There are descriptions of the hunting and fishing, and a number of other attributes of the forest, but there is no information on the mineral resources of the forest. Federal and State agencies also have a responsibility to get out mineral resource information that the public requires.

Ira R. Satterfield:

I don't know that I can add to what Lyn and Jim have said. I think that both the Missouri Survey and the Illinois Survey basically are doing some of the same things that Jim described. It seems to me that the common thread, really, is education, and that thread really hasn't been woven very well. As a matter of fact, education about the mining industry has been very bad, and the public perception of mining is, in fact, worse. The industry is only going to be able to continue operating if the public will allow it to operate. If the public doesn't understand what you're doing and why you're doing it, they are not going to allow industry to operate. What it comes down to is that the job is really ours to do, and the problem is that we just talk with each other, we don't educate other people. That reminds me of the Stanbull family back in St. James where I'm from. Phil and Pat Stanbull had three girls, all one year apart. These girls were very active in high school athletics, especially in basketball. Then along came Tommy, about 13 or 14 years later. All Tommy ever heard at breakfast, lunch and dinner was basketball girls, basketball girls. At each meal the main discussion centered around basketball and his sisters and their role in that sport. For the first few years of Tommy's life he associated basketball only with girls. I asked Tommy one day at a basketball game, "Tommy, are you going to be a basketball player when you grow up?" He just stood up right there on the bench and put his hands on his hips and said, "No, that's a girl's game." Now that's the problem. Just as Tommy's perception was that basketball is for girls only, the public thinks mining is bad. Just as I had to tell Tommy that basketball is for girls and boys, someone has to inform the general public that mining is good and necessary in today's world. We have to educate the people. And it comes down to, as a poet once said, "If you want to look a year ahead, you plant a tree; if you want to look 10 years ahead, you plant a seed; and if you want to look 25 or 30 years ahead, you educate the people." That's why I think for us, for information to be central for resource availability, we're going to have to educate the people. And it is everybody's job, that we do what we have to do.

William M. Sheftick:

I'll talk from a slightly different perspective, at least in what type of information is needed. Being part of a State

Department of Transportation and a large user of aggregates (in fact, Illinois used approximately 25 million tons of aggregates in 1990) we're very concerned about access to economical, high-quality aggregate. The quality aspect comes into play in many cases just as much as where the rock or sand and gravel is located. The problem is that many operators of our existing sand and gravel pits and stone quarries have always taken the easy way out. When they started mining they mined some of their better material, their higher quality material first. What they currently have left is some of the lower quality material. Therefore, they are going to have to go out and look for high-quality type material. These are the needs to be satisfied in the way of geologic information.

From my perspective of heading up a quality-testing laboratory, there are several things we would like to see in the way of available information. These would be: (1) type of material, (2) other geologic information, and (3) characteristics of aggregates.

1. *Type of material*: This was alluded to in Lyn's talk about high-friction material. A high priority of transportation departments is to provide the best road surface and the highest friction for the traveling public. We therefore need information on the aggregate types we use. *Crushed stone*. In Illinois, in this case, we have dolomite and limestone, and the dolomite is a better high-friction aggregate than limestone. We are also interested in sandstone. We have one operating source of competent sandstone in Illinois, and it is one of the highest friction aggregates that we have. *Sand and gravel*. What kind of compositions are they? *Other rock types*. Illinois is not well blessed with igneous or metamorphic rocks that are used for aggregates. We're a carbonate-based aggregate industry along with some sand and gravel of various compositions.

2. *Other geologic information*: We need to know the amount of material available in general areas. For example, in a sand and gravel area, is the material water-deposited along streams, and thus of limited extent, or in a lake or pond of greater extent? How much is above or below water [the water table], because this affects quality. The depth of material available obviously comes into play in the economics of developing a deposit. As far as crushed stone goes, what thickness is available? What's the formation to be used, because a lot of our data is based on age and formation, Silurian dolomites for example.

3. *Characteristics of aggregates*: It is also important to look at the characteristics, the quality of materials. For example, for sand and gravel, how heterogeneous is it? Is it a chert gravel as opposed to a very heterogeneous glaciated gravel which contains igneous and metamorphic rocks. Is it glaciated material such as the big boulder gravels in the Chicago area? How much deleterious material is present? As far as transportation and providing high-quality material for pavements are concerned, we worry about what we consider to be bad actors (deleterious particles) when making or using that material in high-type pavements. What age of glaciation

was it, because weathering conditions of the material directly affect quality. For crushed stone, we again look at deleterious materials and here you can get fairly specific. What specific gravity is the chert? That's important, because low-gravity cherts cause problems in concrete. Overall, is the crushed stone argillaceous? How much clay is present in the crystalline system? Are we going to have problems with clay overburden on top of the rock, that tends to fall in and cause problems in that manner? Clay pockets in the rock, from weathering, cause problems. Shales, if present, are obviously deleterious materials. We even get down to looking at grain size or crystalline strength, in the case of some of our large-grained limestones which do not hold together very well. These are the areas of information that we would like to see developed even more than they are.

Zareh Mozian:

The Branch of Industrial Minerals is part of the Division of Mineral Commodities in the Bureau of Mines. I'm not sure how many of you are aware of our function, but the Division is in the information gathering and dissemination business. The Branch of Industrial Minerals presently publishes information on approximately 75 minerals, most of which are industrial minerals. One of our bread-and-butter publications is the annual report, formally called the Mineral Yearbook. Once a year, in January, we publish the Mineral Commodity Summaries. These cover approximately 90 minerals, the majority of which are industrial minerals; the summaries are two pages each covering the most essential kinds of information. We also have another publication, "Mineral Industry Surveys"; some are published on a monthly basis, some quarterly, a few are semi-annual, and quite a few are annual. We are beginning to publish special reports that get into analysis of issues involving problems with minerals. I think we did something on asbestos a while back. In the very near future, we're going to have two publications, one on crystalline silica and one covering the issues relating to the proposed regulations of some of the deleterious components of some minerals.

H. Lyn Bourne:

Thank you, Zareh. Jim Eidel had a couple of comments that he wanted to make and then we are going to open this to the floor.

J. James Eidel:

A number of the types of data/information that Bill Sheftick just referred to, like glaciation, the depth of the rocks, their age, the deleterious contents, descriptions of the rock, whether there is clay in it, whether there is shale, are addressed and recorded by geologic mapping. Lyn referred in his introduction to Eva Kisvarsanyi's questionnaire to the

Society of Economic Geologists on what maps are needed, and Dr. Leighton talked about the necessity for geologic mapping. Charlie Mankin is one of the fathers of the National Geologic Mapping Act. It might be appropriate to ask him right now to tell us the status of that legislation, because the legislation is a way to acquire much of the information referred to by Mr. Sheftick.

DISCUSSION

Dr. Charles J. Mankin, Director, Oklahoma Geological Survey, Norman, Oklahoma:

The issue addressed was one that the Association of American State Geologists (AASG) identified some 4 years ago as its number one priority, namely, the improvement of high-quality detailed geologic mapping for the Nation. As has been noted, the United States is indeed the most poorly geologically mapped nation in the industrialized world with about 18 percent of the Nation mapped at a scale of 1:24,000. The Association of American State Geologists formed a committee that worked together with a comparable committee from the Geologic Division of the U.S. Geological Survey. Over a 2-year period we developed an implementation plan for the establishment of a national geologic mapping program. That implementation plan resulted in the introduction of authorizing legislation. A bill has been introduced into the Senate by Senator Bennett Johnston with a number of co-sponsors as Senate Bill 1179. That bill was introduced on May 23rd of this year (1991). The House of Representatives, Bill HR 2763, was introduced by Congressman Rahall with a number of co-sponsors on June 25.

The bill essentially authorizes a 4-year program of national geologic mapping. The program contains four basic elements. It was recognized that there is an important ingredient in this activity for the U.S. Geological Survey. If you look in their Organic Act, the USGS is required to study the geology and the resources of the Nation and to report the results of those investigations. We believe that the most appropriate way to study geology is to map it. There is a Federal mapping component in the authorization bill which is to establish a 12 million dollar initial level in fiscal 1992. There is a support mapping component that is to build the necessary related data bases and to improve our capability of converting field information to printed format either in digitized or other forms for public use. The third component is the State geologic mapping component with an initial authorization of \$15 million. That mapping component requires matching funds on a 50-50 basis in the States. Those mapping efforts, in particular those of the States, were to establish a 1:24,000 scale for mapping with eventual publication at a 1:100,000 scale. A final component, one that was noted earlier, is a geologic-mapping education component. As many of you know, colleges and universities today are

increasingly turning out geotechnicians who run fancy equipment and machines in laboratories, and increasingly are forgetting that geology begins in the field. So this component initially authorizes \$500,000 for grants to colleges and universities to assist in increasing the training in geologic mapping.

I might just comment briefly to say that the State geological surveys have been working very, very hard, along with a number of other organizations, such as the Society of Economic Geology, in supporting this legislation. Hearings have been held in both the Senate and House. I think they went over well. We are increasing the number of co-sponsors. We expect to have 25 to 35 members of the Senate and perhaps 50 or more members of the House as co-sponsors of their respective legislation. The bills will be marked up in the Senate within the next 2 weeks. We anticipate that the markups will go through; we were very pleased to find that a number of key members, such as Malcolm Wallop, have agreed to co-sponsor. He is a key person in the Senate Energy Committee. On the other side, the authorization bill in the House will be marked up the first week in October. We anticipate that these bills will be voted on by the respective houses, and we would anticipate this legislation being enacted into law and signed by the President sometime later this fall. [Editors' Note: The National Geologic Mapping Act of 1992 was finally passed by the Congress and signed into law by the President on May 18, 1992.] This program, we think, is critical, it is the number one issue that the Association believes is necessary to meet a variety of our other applied needs, the kinds of things that we have to do in dealing with the public on a daily basis.

Anthony M. Bauer, Landscape Architectural Program, Michigan State University, East Lansing, Michigan:

My comments are based upon more than 25 years of working with mining industries in trying to obtain permits for operations and in working with communities in general planning for mining operations. I have several issues to raise. First, about resources inventory. It seems to me that we need to obtain information about these resources from three sources. First, the geologic information on the State level; for example, I see the State providing data that indicates high probabilities of sand and gravel deposits. Second, more specific information would be forthcoming from the local government, based upon existing mine sites, well records, and road cuts. The third level is the industry's own efforts. They, of course, provide site-specific information. The key point that is missing in most situations is the local level of data. If the local level would be involved in the inventory process, then it would be likely that more effective planning of mineral resource usage would occur. Today few communities consider this step in the planning process.

The second point I want to make relates to the comment on the permitting. It has been my experience the permitting

at the State level is the easiest part of the process. They have overview, they have oversight, they have general understanding of the issue. It's when you get down to the local level where there is a lack of understanding about the role the aggregate industry plays in society. A good deal of that problem lies in the planning department and the planning people themselves, because most planning people do not have a physical science background, nor a basic understanding of the nature of the geology or industry. I agree with the comments regarding the need to educate the public, but I suggest one of the key groups of people that we need to educate are the planning officials and planning people in the local communities.

H. Lyn Bourne:

I would add the comment that often at the county and the State level, you can present rational or factual information and it's debated in terms of accuracy or whatever. But often at the local level, the issue becomes emotional and not rational; I think that if we are able to educate the public, we may be able to turn that reaction around and deal with something that's based more on factual needs and get away from some of the emotional issues.

J. James Eidel:

I would like to comment on the scale that you referred to and the three levels. In Brud Leighton's talk this morning he had a bullseye type diagram with three circles. The outer circle was the USGS-State program called CUSMAP which is mapping geology and resources at a scale of 1:250,000, an inch equals 4 miles. CUSMAP is involved in mapping industrial minerals. The second scale, the inner circle, was a scale of mapping at 1:24,000 or 1 inch equals 2,000 feet, which is the scale the National Mapping Act addresses. This leaves the bullseye as the local scale providing the detailed geology that a mining company requires. The bullseye of the map was the geology that a mining company has to consider, including close-spaced drilling to find the resource itself. I think between that diagram, Tony, and your comment, we ought to be able to address and define the level to which you refer.

Dr. Morris W. Leighton:

This is on a slightly different subject but related to information essential to resource availability. Perhaps we also ought to list limiting factors or have maps on limiting factors, exclusionary areas, for example. Wetlands haven't been mentioned to any great extent, yet. Of course, as we get into the environmental issues, no doubt some of these will be coming out. But perhaps in the question on mineral availability, we should be addressing and listing some of these factors as well.

Edwin W. Tooker, U.S. Geological Survey, Menlo Park, California:

I want to add some information about available commodity specialists in both the USGS and USBM. They are listed in the appendix of the report on the California Industrial Minerals Workshop in USGS Bulletin 1958 [Tooker and Beeby, 1990]. One other thing considered in the California Workshop bulletin has to do with education. This was a program that has been very successfully mounted by the Nevada Division of Minerals, through which they are educating public school elementary and secondary level teachers. They have a whole series of programs of workshops, field trips, etc., and they also provide for continuing education at the University of Nevada. Their idea is that if you teach a teacher, you reach a lot of students. They have an interesting description of that program in the bulletin.

H. Lyn Bourne:

The foundation I referred to as part of SME is selling and distributing videotape films that deal with the mining industry and is making them available to schools and teachers. And the foundation is active in trying to work with teacher organizations, so it's kind of a grassroots thing now, but we're hoping for a groundswell.

Edwin W. Tooker:

The mining industry in Nevada is sponsoring this, paying for this education program, and they provide scholarships to teachers to go to the universities for courses. It is a really important program of public education.

William V. Bush, Assistant State Geologist, Arkansas Geological Commission, Little Rock, Arkansas:

Two items that are essential for mineral resource availability are topographic maps and geologic maps. The government agencies that push for these programs are the State geological surveys and the U.S. Geological Survey. We need the support of the users in obtaining funds for these two programs.

The 7½-minute topographic map coverage in the United States is complete, but the job is not done. [Editors' Note: Despite completion of basic coverage, map revision can never be completely up-to-date.] Last week in Rolla, Missouri, at the Midcontinent Mapping Center, State surveys and other State agencies that support topographic mapping made their number one priority the 7½-minute topographic map revision program. The revision program is almost as important as the original mapping program. If we don't keep them up to date for the users, then the program has failed in its mission. This message needs to be conveyed to the users because their support is necessary to obtain adequate funding

for the topographic map revision program. It's a monumental task. I think there are about 54,000 7½-minute topographic maps for this country. [Editors' Note: 53,548 maps cover the 48 conterminous United States.]

Equally important to the industrial mineral industry are the geologic maps. The National Geologic Mapping Program is also a monumental task that will not be a success without proper funding. The AASG is pushing for this program, the AASG is behind it, but again the support of the users is essential for passage of this legislation and adequate funding. Only then can a mapping program get underway.

Alfred L. Bush, U.S. Geological Survey, Denver, Colorado:

I want to add one comment. I would like to emphasize the fact that there is no such thing as an all-purpose geologic map. Simply to have mapped a quadrangle at the 7½-minute scale is usually not a final answer. You always map a quadrangle with something in mind; you may not realize the bias, but the bias is there. It may be necessary to go back and remap that quadrangle at the same scale for a different purpose. The job is really never done. That is not to discourage anyone, but it is to say that just because a map is out doesn't mean that the job is completed.

Timothy S. Hayes:

The next panel session is on land-use planning and the industrial minerals, and the panel leader is Robert Joice, the Long Range Planning Manager of the Lexington-Fayette Government Center.

LAND-USE PLANNING AND THE INDUSTRIAL MINERALS

Panel leader:

Robert S. Joice, Long Range Planning Manager, Lexington-Fayette Urban County Government, Lexington, Kentucky.

Panel members:

Kent M. Bratton, City Planner, Cape Girardeau, Missouri.

Mark L. Falloon, Planning Director, Franklin County Planning Department, Union, Missouri.

D. Anne Lewis, Chairman, Missouri Land Reclamation Commission, Jefferson City, Missouri.

Robert L. Pinkerton, Executive Director, Southwestern Illinois Planning Commission, Collinsville, Illinois.

J. Kurt von Achen, Chairman, Eudora Planning Commission, Eudora, Kansas.

PANEL PRESENTATIONS

Robert S. Joice:

[With Mr. Joice, James R. Rebmann coauthored a paper provided at the conference and also provided considerable assistance in preparing Mr. Joice's presentation to this panel. Mr. Rebmann is the Senior Environmental Planner of the Lexington-Fayette Urban County Division of Planning with primary responsibility for planning activities related to industrial minerals.]

Today's panel on land-use planning has a variety of persons with backgrounds complementary to the talk we heard this morning. We have professional planning directors, and lay persons who have worked in planning, one local planning commission chairman, and the other who is chair of a statewide committee dealing with planning for industrial minerals. I will introduce the problem of planning for quarries in a way which is more specific but I believe complementary to Mr. Sieben's talk [see above, page 21]. We will



Figure 26. Downtown Lexington, Ky., emphasizing new construction and scale of building. Photograph from Robert S. Joice and James R. Rebmann, from files of the Lexington-Fayette Urban County Division of Planning.

then have three professional planning directors speak of their experiences in Illinois and Missouri. They will emphasize the varying local information needs and standards required for proper planning. Then we will have two persons who are professionally involved in design, but have experiences in quarrying regulation from the perspective of a lay committee member. Each person will make introductory comments and we will have time for questions.

We've been working on a planning process to write a new ordinance in Lexington [Kentucky] for the last couple of years. It took that long, actually it's 2 years, and we really don't have it adopted yet. But I'm going to emphasize some of the problems that I think kind of set the stage of the issues here, and then I think each of the panel members will add a couple of comments, and we'll open it up.

Lexington, Kentucky, is, just for your background, the heart of the Bluegrass, and it's a diverse community of 225,000 people. It has a vibrant downtown, a historic tradition over 200 years old, rural horse farms that are well known throughout the country, and a lot of suburban development. This is a shot of downtown (fig. 26). There are three quarries in town supplying the needs of construction and growth. One is about 4 miles from downtown, one's about 1 mile from downtown in a different direction, and the other is about 12 miles from downtown. In many ways, Lexington's planning and the framework for these kinds of decisions is kind of like Kane County. One difference is that Lexington isn't as flat as Kane County, I believe.

One very important planning concept in Lexington is an urban service area boundary (fig. 27). We divide Fayette County distinctly into an urban area (unpatterned) and the rural area (shaded). Three-quarters of the county is identified as rural, where approximately 6 percent of our people live; 94 percent live in the urban area. We specifically discourage growth in the rural area to preserve it for horse farms and, frankly, incidentally for minerals and mining, etc.

For general background, too, Lexington is located on the Cincinnati arch. The mineral deposits are primarily limestone in the [Middle] Ordovician-age Tyrone and Camp Nelson Limestones. We have two underground mines and one open pit mine. The open pit mine is in the Tanglewood Member of the Lexington Limestone [Middle and Upper Ordovician], just for your background.

Now there are three kinds of concerns that we had in Lexington (fig. 28). We have problems that are directly associated with the mine itself, whether it's a pit style mine or a deep quarry. We have problems associated with adjacent lands and the relationships with the mine. Then there are problems specifically with transportation, getting the materials to and from the site. On the site we outline these areas, physical characteristics, etc.

Figure 29 is an example of an open pit mine that has been in existence for many years. It is located right next to an interstate interchange, and is a good example of what can be done with a played-out site, from a planning perspective.

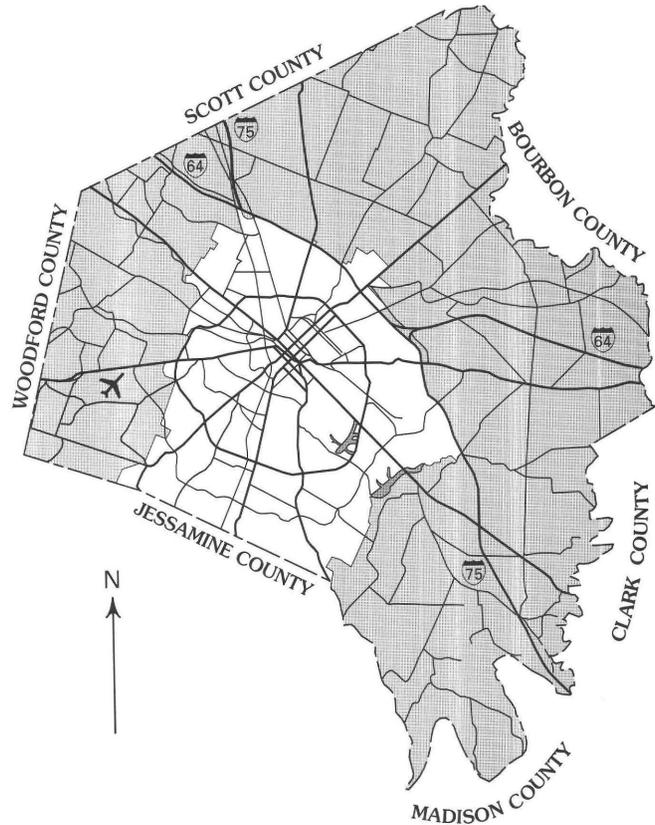


Figure 27. Urban service area boundaries, Fayette County and City of Lexington, Ky. Urban area unpatterned, rural area patterned.

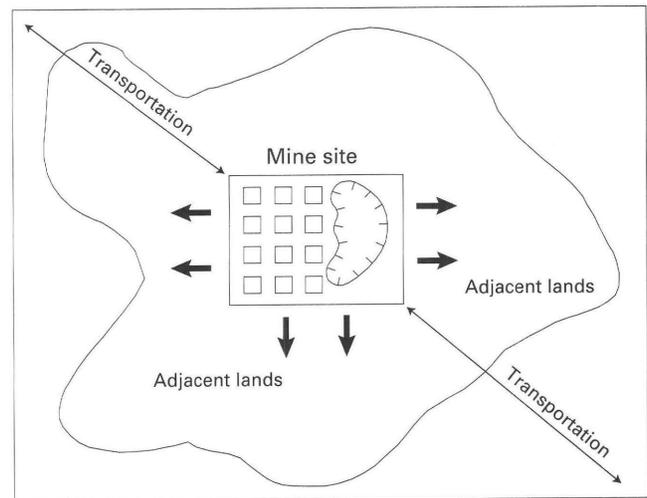


Figure 28. The three physical concerns with the environment in mining.

Recreational uses can be made, water-filled areas for ponds, a site for a shooting range, etc. Figure 30 is of the Clays Ferry underground mine (most of the mining is actually deep pit here). It's down below the surface. This is about 12 miles from our downtown area.

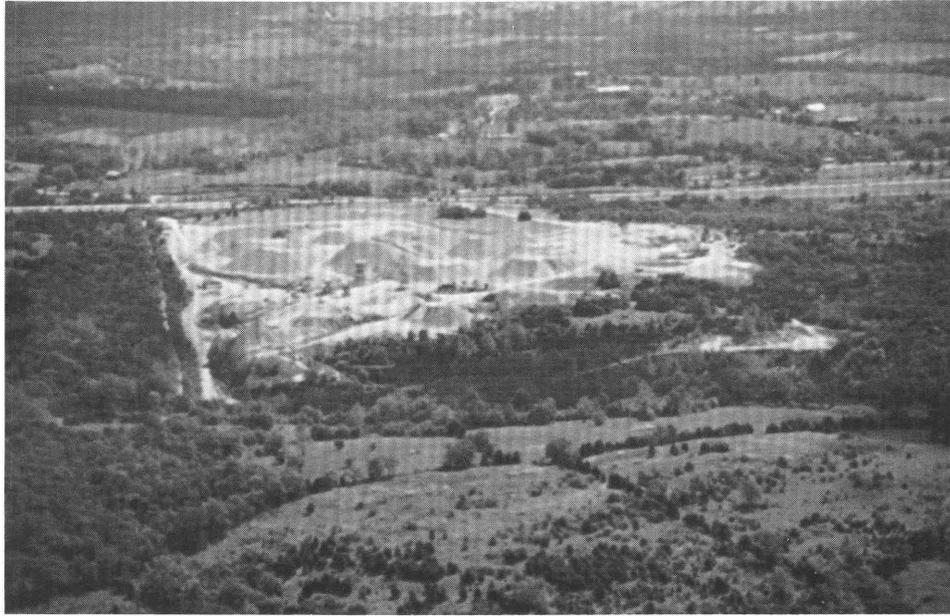


Figure 29. Open pit aggregate mine in Fayette County, Ky. Photograph from Robert S. Joice and James R. Rebmann, from files of the Lexington-Fayette Urban County Division of Planning.

The problem with adjacent lands is illustrated by figure 31, a shot of the Kentucky River and the undeveloped area nearby, and by figure 32.

This is Elk Lick Creek adjacent to a quarry site (fig. 33), with spoil deposits very close to the edge of the stream. Figure 34 shows Elk Lick Creek a bit downstream with product rock from the quarry, deposited along the creek as a result of accidental or sloppy product storage. Gravel and rock flour have spilled into the stream, creating a high sediment load, a killing effect on the aquatic life, and a violation of the Clean Water Act.

Limestone mining in itself is not a widespread water polluter; however, this mine had water in the bottom and as they were de-watering it, they were polluting the creek. The permits from the National Pollutant Discharge Elimination System (NPDES) require adherence and a review of the area, so a clean-up of the mine and adjacent Elk Lick Creek was required.

We are always confronted with the issues of adjacent lands and politics. For example, the Iroquois Hunt Club, the second oldest continuously operating hunt club in the United States, is indicative of the kind of activity in the rural part of our county. The people there have historic homes and have a great deal of interest in the mining problems that developed. Were it not for their interest, perhaps the pollution would have gone undetected.

The hunt club was actually 2 miles away from the specific site, but its presence brings up the importance of planning in the rural area and distinguishing the rural area from the urban area. Planning can make the regulatory environment more suitable for mining, but it doesn't always deal

with the political problems. You still have to have proper operation of activities on the site.

Transportation is another big issue in quarrying. Obviously, you can have trucks that are too big for the roads, and you need to have adequate roads nearby. Because of dust problems, we have an ordinance that requires trucks to have their gravel covered, but it isn't always followed. Obviously you need follow-up street cleaning and other such activities partially because of materials transportation.

In 1989, Lexington created the Quarry Committee. The committee was charged with protecting the environment while maintaining an important industry. This committee has discussed many topics of importance relating to environmental concerns, as well as topics dealing directly with planning issues, such as: whether a conditional use permit or an exclusive use zone is more appropriate; whether to merely enforce existing rules or enact stricter legislation; and whether local or State and Federal laws should be most directly applicable.

I'm not going to get in as much information as I'd like about our proposed regulation, itself, because we want to have more discussion. Papers that briefly talk about what we've done and copies of the ordinance are available, but I want to make one comment, as most of you are from a background of geology. Recognize that planning regulations go with the land and that there are a couple of things here that are very important. First of all, it's hard to regulate an ongoing use like quarrying. We regulate it once through the land-use planning process and designate whether or not it is in an appropriate location, but it is much harder for planning and zoning laws to regulate beyond the initial opening of any facilities. And you all recognize and we planners recognize



Figure 30. Clays Ferry aggregate pit and underground mine, in the Middle Ordovician High Bridge Group (limestones), Fayette County, Ky. Photograph from Robert S. Joice and James R. Rebmann, from files of the Lexington-Fayette Urban County Division of Planning.

that many of the quarries were existing uses before zoning was established. Second, there was a comment made earlier about zoning in many counties. Well, I know in Kentucky, the majority of the counties do not have county-wide zoning. The large urban areas certainly do, but there are many counties that do not have zoning county-wide. Zoning has its limitations, and in our case we had to get considerably more detailed in a permitting ordinance than in a typical zoning ordinance.

And, finally, with regard to ordinances that go beyond zoning, the comment was made, and I respect it, that you need to educate planners. Well, we look at our government, and we have a large governmental staff, a large planning staff, and a large engineering staff, but the more we get into these issues, the more we question the adequacy of our staff resources. Do we have a geologist in the engineering department or in the planning department? Not really. We have somebody who has a fairly good geologic background in the planning department, but not somebody who is capable of



Figure 31. Unspoiled Kentucky River countryside, Fayette County, Ky. Photograph from Robert S. Joice and James R. Rebmann, from files of the Lexington-Fayette Urban County Division of Planning.

administering ordinances that could be much more specific than those at the State level. And that, of course, is a significant problem that I think every community might have.

Next, Bob Pinkerton is going to speak. He's the Executive Director of the Regional Planning Commission for the eastern side of the Metropolitan St. Louis area, and he has many years of experience throughout Illinois.

Robert L. Pinkerton:

I want to tell you, relative to some of the comments that were made from the floor a few minutes ago, that some of us planners do have a physical science background; I'm a geologist that kind of went off in the wrong direction, I guess, and became a regional planning director. I did that the day after I got my geology degree, so, here we go.

I think that this panel in particular is oriented differently than many of you might be. We are at the working level where decisions are made and do not ever forget, please, that



Figure 32. Recreation trail through an undisturbed area in Fayette County, Ky. Photograph from Robert S. Joice and James R. Rebmann, from files of the Lexington-Fayette Urban County Division of Planning.

when we start talking about planning, we start talking about permitting, we are talking about local government, we are talking about politics. Not politics in the sense that you may relate to the national level where we have big parties and major platforms. We're talking about the gut politics of someone making a decision on a land-use issue, whether it be a permit, or whatever.

My organization is reluctantly, or relevantly, called, SIMAPC, that's the acronym for Southwestern Illinois Metropolitan Regional Planning Commission and its seven counties just across the river [from here]. We are one of the two regional planning commissions in Illinois that were created by the General Assembly. The other one is up in the Chicago area called NIPC (Northeastern Illinois Planning Commission). All the rest of the planning commissions in Illinois are created by loose associations of counties. But because of SIMAPC's creation by law, we are charged to do a number of things. One of those things is oversight in public decision making. We spend a lot of time and effort in oversight issues such as, "Why did they do it this way?" Sometimes there is not a good answer to that.

The SIMAPC area has about everything in it, karst topography, floodplains, mine subsidence, and it has [the metropolitan problems of] East St. Louis.

I would also like to comment that all States have their own specific laws, and they relate particularly to local organizations. We, in Illinois, are the most proliferated government of all the States, having about 6,500 units of local governments, twice the number of any other State, and that makes doing business in Illinois a little more difficult.

However, some of our ancestors did something right in the State of Illinois by allowing the creation of our three Surveys, the Geological Survey, the Water Survey, and the Natural History Survey. And, ladies and gentlemen, we are very proud of them. They do a tremendous job of supporting us at the local level, and we encourage their budgets and other things, for funding is always a problem in Illinois.

There was a comment made in the prior session that there needs to be some sort of a forum or a central place to talk about these kinds of issues. Well, in Illinois, we may have one, by accident. I call it SMAC, that's the State Mapping Advisory Committee. It's a group that is interested and meets throughout the year to look at the USGS mapping requirements for the next year; we just had a meeting a couple of months ago to talk about next year's requirements for Illinois.

But that's only one of the things that group talks about. Many of the other things are GIS-related because all of these folks (I happened to be the only local government guy that goes to SMAC meetings) come from the three State surveys, from the departments of State government, the EPA's, and wherever else land-based technology exists in Illinois government. They talk about the levels of information that they are currently working on, and what the availability of that information might be.

The prior group today had a list of things, and I thought, "That's my GIS program right there." And, I'll tell you, too, that we need your help with GIS. Those of us that are working at the local governmental level have the most limited financial assets of anyone. In Illinois we have to get it from



Figure 33. Elk Lick Creek, Fayette County, Ky., adjacent to a quarry site, showing quarry spoil deposits along creek, foreground, and on slopes of valley in background (through the trees). Photograph from Robert S. Joice and James R. Rebmann, from files of the Lexington-Fayette Urban County Division of Planning.

the counties and from the cities. As many of you know, maybe with your personal relationship with your own cities, finances are not easy to get, particularly for costly systems such as a Geographic Information System. SIMAPC happens to have an ARC-INFO system and we are just now getting started. It took a lot of my current annual budget to even acquire the equipment and purchase the program. Now as we begin to layer information, we are hoping to rely upon many of you to share with us the levels of information that you may have. Again, the developers come to us. We work with the local governments, whether it be the counties or the cities—in SIMAPC there are no county planning agencies, just us, and we work with most of the municipalities. We need that kind of information, if, in fact, we are to be able to address the kinds of issues that are being discussed at this conference. Levels of information are essential to the planning community, and as we move into the 1990's, we have in Illinois finally broken that real problem and that big gap

we had from dealing with everything by hand and on paper. We've got to be able to do it electronically if we are going to assemble all the information, be able to overlay it, and tell our county boards and our city councils that here is a rational way, for once, of making a decision on a zoning issue. Whether that be a quarry or whether it be something else.

One of the things that I didn't hear this morning I would like to bring up. This comes from my years of experience in Illinois; I'm the most senior of the planning directors. I've been at the Tri-County Planning Commission of Peoria and at the Champaign County Regional Planning Commission. In fact, I wrote their zoning ordinance about 20 years ago. The subject is borrow-pits. I look at dirt as being one of the biggest problems that planning agencies have. Particularly as one builds interstates, and now supplemental freeways and whatever Congress authorizes to succeed the interstate system, we still are going to need that "fill" material. Quite frankly, we don't have a good record in Illinois of where borrow-pits have been put. We have from time to time through the Planning Commissions suggested that those pits be located and configured in certain ways so that they have a reuse value. When I was in Champaign, they were just finishing Interstate 57, which runs north and south through the county. Borrow-pits were all over the place. Little attention was given to where they were located. At that time, I believe, the Illinois Department of Transportation was acquiring the property and then letting the builder dig on that property. However, there were so many pits and they were so scattered that the Regional Planning Commission there had to publish a directory and number all of them; there were drowning accidents and people couldn't find that particular gravel pit or borrow-pit. I don't see the matter of borrow-pits going away—I think we're going to constantly have them. When you get into the suburban areas where they're building the new highways, we really need to work together to make sure the pits are put in properly so that they do have an urban reuse value, regardless of what that might be. It could be as a residential subdivision, it could be anything. In a way that is a reclamation of a site.

We are building a better technology in planning, and I think one of the reasons for that is because we now have so many environmental laws. In order to deal with those, we have to know what the environmental issues are, what the assets are out there, and what the liabilities are with those properties.

We have a program in Illinois called LUST. And when I talk to Rotaries I start on that, and everybody sits up and then I tell them that's the Leaking Underground Storage Tank program. Then they all go to sleep. But along with that program goes the Responsible Property Transfer Act. I think that is an excellent law, but in order to support the law and implement it properly, we have to have this layered information. Where are the old landfill sites? Where are the old leaking underground storage tanks? Where are the storage tanks we don't know about? All this need for information



Figure 34. Elk Lick Creek, Fayette County, Ky., downstream from a quarry site, showing deposition of quarry spoil along the banks, forming terrace deposits several feet thick. Photograph from Robert S. Joice and James R. Rebmann, from files of the Lexington-Fayette Urban County Division of Planning.

comes about because in Illinois we have finally turned the table around to the point of being able to practice land planning in a much more sophisticated way, to deal with all the information which is there, but which we cannot handle unless we do it electronically.

Robert S. Joice:

Our next speaker is from Cape Girardeau [Missouri]. He's the Director of Planning Services there. Kent Bratton has 15 years of experience, and he also has degrees in geological science. Kent.

Kent M. Bratton:

I'm like Bob, I'm another geologist that erred and went into planning. I started in January of 1972. I'm a little more fortunate in that I had the opportunity to be in the same place for 20 years, and, early on, developed a very close working relationship with our State geological survey [Missouri Division of Geology and Land Survey]. Back in those days, we really didn't know much about anything down in our neck of the woods. The bulk of our area was covered with 15' topographic maps, but there was very little geologic mapping. Of course, the Missouri Survey was very strongly rooted in mineral resource development and they had just started looking at urban planning type issues. Over the years we have had the opportunity to work on some pretty unique projects. I

think there is much more to do, but I'm very comfortable in feeling that at least, from their end and our end, we know what needs to be done and we know where to get what we need to get it done.

In Cape Girardeau, again, we are fortunate; our limestone and sand resources are not in any great peril and probably won't be for at least the next 10 to 15 years. We have a very active planning program and are in a position, I feel, to avoid a lot of the problems that some of the larger areas are experiencing. One of the things that we are looking at hasn't been mentioned yet; to us one of the keys is the development and timing of the infrastructure that supports development. If you don't put in roads, if you don't put in sewers, if you don't put water lines anywhere near these places, then you're not going to have development. Now that raises other issues and other problems. Again, we may be unique, I think, in being able to keep these facilities out of these [mineral resource] areas for some time to come. From the standpoint of the minerals industry, I think that's something that you need to keep in mind as well. When you put in a road, or you demand that the government put in a road for you and a water line, perhaps to a certain extent you are inviting some of the very problems you are trying to avoid. Before I took the job at Cape Girardeau I saw this happen in one of our northern counties, where they needed a major access road. That area of the county was basically isolated until that road went in, and at that point the area became immediately accessible to everybody.

Two previous speakers have cautioned about not relying on county zoning. Missouri is unique. Under Missouri county zoning law, a county zoning authority cannot regulate mines, even if they want to. Only cities can, so there is very little control placed on mining, at least out in the rural areas.

There is another aspect of establishing control around some of these mineral operations. If a city establishes restrictions around a quarry, we may have the specter of a “takings” issue if we restrict development. And when we deny that property owner a reasonable use of his property, then we have taken from him to a certain degree. The Supreme Court has been all too willing to say that we have to pay for it, and the “we,” all too often, is the city or county involved. That’s another issue we won’t spend any more time on, but from a planner’s standpoint it is very real and it is here.

Robert S. Joice:

Mark Falloon, our next speaker, is also a Planning Director, from Franklin County, here in Missouri.

Mark L. Falloon:

Franklin County is located about 50 miles southwest of here, adjacent to St. Louis County. It contains about 922 square miles with about 80,000 people. We deal strictly with the unincorporated areas of the county.

We were granted planning and zoning authority by the people in 1966, adopted our first subdivision regulations in 1970, and adopted our zoning regulations in 1986. Due to the finances and funding that the county is able to provide us, we pretty much act as referees between developers and development, trying to assure quality growth throughout the county. And I guess the underlying factor to most all of that is to save public funds, to make sure they are used wisely.

Our zoning order does have authority in about 80 percent of the county, that which is zoned for agricultural, mining, and other extractive industries. We review all these uses through a conditional use permitting process. Public hearings must be conducted, public comments solicited, and then the Planning and Zoning Commission makes a recommendation which is forwarded to the County Commission. The County Commission, three elected officials, makes the final decision.

We don’t have many quarries or sand and gravel operations, but we do have a few. One sand and gravel operation did decide to relocate, applied for a permit, covered all the areas of concern to the public, and eventually was granted their conditional use permit. On the other hand, an individual decided he wanted to expand his quarry; he was a small-time operator who had an existing quarry of about 5 acres or less. He decided to relocate, found a farm of about 150 acres, and decided that he wanted about a 10 acre plot in

about the middle of it. He presented his case before the Planning Commission, but ignored our recommendation to him to conduct a survey and present the survey plat, identifying where he intended to conduct his business. He ignored that and showed up at the Commission hearing; basically he just said he wanted to open up a new quarry, but did not provide adequate information and was unable to identify where it was going to be located on that farm. It was to be sited wherever it was deemed to be best suited. The end result was that he was denied his permit.

The regulations focus on three things. In our area a permit would probably be granted if these areas of concern would be addressed properly, that is (1) what will be the effect on the environment, (2) what will be the effect on the transportation system (is it going to increase traffic too much, is it going to destroy the roadbed, etc.?), and (3) what will be the effect on surrounding uses (are you going to diminish property values substantially, what have you). The hearings are conducted, we keep to the facts, make recommendations based on facts, and then the County Commission will provide the political input, the public opinion, and may reverse the Planning Commission’s recommendation.

The key to all of it, I think, is education, as was mentioned in the previous panel discussion.

Robert S. Joice:

Our next speaker is a landscape architect with 10 years experience; she is a gubernatorial appointment to chair the Missouri Land Reclamation Commission.

D. Anne Lewis:

The Land Reclamation Commission is half statutory members: the State Geologist (Dr. James H. Williams), the Director of the Department of Conservation, and the Staff Director of the Clean Water Commission; and half the gubernatorial appointment people: myself (a landscape architect), a farmer, a retired SCS (Soil Conservation Service) agronomist, and a representative of the industry that we regulate.

The Commission acts as an out-of-house board of directors for the 25-person professional and technical staff which is housed within the Department of Natural Resources, State of Missouri. On that staff are geologists, an agronomist, lots of foresters, and a professional engineer. The program administers the abandoned mine land program (coal mines), and we also have primacy to administer SMCRA, again regulating surface coal mining. For 20 years, since 1971, industrial minerals have been regulated by State statute. In the absence of any Federal statutes, we are the highest governing authority. The industry in Missouri is organized, they are vocal, and they are predominantly friendly. The kinds of things that we ask of them, and this has been upgraded in the last year (I see a smile; I should see several frowns), in the

last legislative session, we passed new, I'll call it more stringent, legislation. Right now we are in the final throes, in the public comment period on industrial minerals rules and regulations with which we will truly administer the law.

On the subject of public education, the National Stone Association for 14 years has sponsored a competition, a national competition, for landscape architects, to come up with post-mining land-use site plans, development plans specifically for industrial minerals properties. I tried very hard to get slides of the winning entries and was unsuccessful. That's a public education opportunity that we've missed. I know that these winning entries are published every year, in *Rock Products* magazine, so many of you might be aware of them.

An unconnected thought, but I think the point is to get some thoughts out. As we're going to be together for an afternoon, you can fire questions at us only if you know what we do. From my standpoint, as a landscape architect, I look for the creative opportunity allowed industry by regulation. By that I mean, in the coal law there is an opportunity that you can substitute other property in your reclamation plan if you choose to do so. You bring it before the Commission, we review it, and if it is decided that it would be more appropriate to reclaim one of your pre-law pits, which happens to be adjacent to a State park, for instance, than the pit that you are planning on opening, that can be facilitated.

A similar thing in the coal law is that you can leave 25 percent of your land "lumpy." I'll just use regular old terms. Let it be wildlife habitat; you needn't put it back to grazing land or whatever is considered the best use.

A third unconnected thought, when you look at the cadastral ownership maps in southern Illinois, specifically, at who owns old mine sites, you'll find diving clubs, raccoon hunting clubs, groups of doctors who go out and shoot deer, the Audubon Society; you'll find the Eckert family of apple orchard fame own a bunch of them, too. I bring this up as evidence of an opportunity. There is no other industry in this Nation that I can think of that has the capability to move earth as easily or as inexpensively as industrial minerals and coal operators. If there could be some sort of collaborative venture between planning departments and industry, if there were some way to work together so that this opportunity to move earth could be used to its greatest, mutually beneficial advantage, that would certainly be a happy day in my opinion.

Robert S. Joice:

Our final speaker is J. Kurt von Achen, an architect for more than 20 years, a Planning Commission Chairman for most of 20 years, with an additional few years on the Planning Commission before that. The Eudora [Kansas] Planning Commission has had the pleasant or unpleasant opportunity to review several quarrying applications just within the last year.

J. Kurt von Achen:

As with Dudley Blancke, my comments are aimed at producers because they are who I'll see from my side of the table. I am a member of that quasi-political group called Planning Commissioners. Maybe it's a good thing there aren't too many producers here; I might fear for my life. You as producers need the majority of our votes, and you will face 3 to 10 of us wherever there are zoning laws. You need a majority of our votes before you can get to the real politicians that make a decision. It seems to me from the comments made by Tim Haithcoat and Dudley Blancke that you folks are caught in the swing of environmental ethics, and I think my comments will echo what they said, only not as eloquently.

The zoning laws have come in the last 20 years or so, in most of our part of the country, and so you are faced with many regulations. Zoning regulations are here to protect you and me from our neighbor. Planning Commissioners in a good part of the country will look at an issue and they will make a rational decision. You know a rational decision is one you agree with and an emotional decision is one with which you do not agree. So, you are no different from the rest of the applicants that face us. Zoning laws are to protect us from our neighbors, so when you want to change zoning on a piece of property, you are going to have to convince us that it is in the best interests of the community as a whole. Planning Commissioners will decide in favor of your neighbors unless there is an overwhelming community benefit from your request for change.

You have three tools: truth, mitigation, and reclamation. Truth is your best tool, and tell us all of it. Don't tell us just 98 percent of the truth, because there is someone in the community on the opposition who will point out that other 2 percent and it will be a bigger factor than the 98 percent that you brought to us.

Document truthfully that the community needs the product that you are going to produce, and remember that we understand that your actions aren't totally altruistic. You are in this business to make money just as we are in business to make money. Forget the old saying, "If you can't dazzle them with brilliance, baffle them with bull." It won't work anymore. We are fairly sophisticated and we have some sophisticated staff.

A side comment to one that was made to the last question. I'm going to defend our planning staff. They are professional and they are doing a good job. They are caught with something that also affects Planning Commissioners. When planning, zoning, and land use came into being, there were often some tradeoffs made with governing bodies and with residents of counties and cities who did not want any controls on their property. Those tradeoffs have come down to us in the form of exemptions that allow development in rural areas. While we as planners and planning staff can say we want to maintain the rural areas, the prime farmland, and to control

urban growth, we are up against city and county commissions who will not get rid of those exemptions. We have found that in Douglas County, Kansas (my home county), 80 percent of the homes built in the last 10 years have been built on unregulated land because of the exemptions.

Look the planning staff squarely in the face and tell them truthfully why you need the material and why the community needs the material. Tell them truthfully how long you will be in the pit. Don't try to make us believe you're going to sell a million tons of rock a year out of your pit when everybody else in the area is working hard to sell half a million tons, and you will be adding to the inventory. Look objectively and compassionately at your application and its effects on your neighbors. Determine what mitigation activities you would want if you were one of your own neighbors. Then come to the table with those mitigations. Don't be pushed into them. As John McCoy of Martin Marietta has said, "Never try to negotiate conditions at a public hearing." Have those things settled in advance. Work with the planning staff so that you know where you are when you come to the meeting.

Reclamation. The State of Kansas doesn't really require reclamation of rock quarries at the present time. Reclamation of coal mines is required. However, local jurisdictions will require you to reclaim the property as a condition of the permission to quarry. You may not have to show what the final development is, as you do in some counties, but you will have to show a reasonable reclamation plan. Don't try to show us a bunch of fluff. We are sophisticated enough to know that the sedimentation pond has to be at the lowest point of the property. Don't put it up on the hill and try to make us believe that that's where it will be.

Follow the rules. If the zoning law says, "Post the property," post the property, and keep it posted. Make sure that your application is complete in accordance with the zoning rules and be sure you are published in the official paper on time. Make sure you have covered all the bases with other regulatory agencies, because you are unlikely to receive local approval until you can show that you either have the other permits required or that you are close to obtaining them.

Approach your neighbors with respect. Talk to them. Give them plenty of information. Work hard to win them over before you get to the public hearing. Neighbors who are knowledgeable and comfortable with your application will not fight you.

Pursue your application on its merits. Don't try politics. The merit of an application, if it's right, will win the day.

A couple of more "don'ts." Don't belittle your neighbors in public hearings. Recently at a public hearing we had an attorney imply that he wasn't going to distribute some of the technical information because the community at large couldn't understand it. A man well known in the community stood up and said, "I may have started my education in a one-room school house, but I got my doctorate from MIT.

I'd like to see the information." That exchange did the applicant great damage.

Next, don't employ an attorney to represent you who is politically connected. A politically connected attorney can do one of two things for you: he can give away the store, because by giving away the store he gets you the "yes" votes and maintains his clout, or everyone concerned on this side of the table and in the neighborhood will know he's politically connected (that's why you hired him) and it will hurt you.

Finally, don't promise anything you can't deliver. Don't promise to have the trucks tarped, because we know that most of the truckers are independent contractors, over whom you have no control. Zoning regulations, once the permit has been given, are very difficult to enforce. Planning Commissioners don't have police powers. We know that we cannot enforce many conditions to a permit and, therefore, prefer that you volunteer to be a good citizen with your application. Remember, good applications do receive approval. It is the incomplete, sloppy, and untruthful applications that fail.

Robert S. Joice:

Are there any additional comments from the panel? Let's throw it open for comments and questions from the floor.

DISCUSSION

H. Lyn Bourne:

About 20 years ago, there was a planning group in southeast Michigan, the Southeast Michigan Council of Governments, SEMCOG, that represented a seven-county area around the Detroit metropolitan area. One of the things they were charged with doing was to develop a land-use plan up through the year 2000. They looked at industrial needs, institutional needs, commercial needs, residential, agricultural. But when it came to mines (for all practical purposes, we are talking about sand and gravel and quarry operations), they merely plotted the existing operations, many of which were already depleted at the time that their map went to publication. They made no provision for any additional land for mining through the year 2000. Now, I've recognized that some of you have a background in geology and by virtue of participating in this Workshop are aware of some of the problems. My challenge to all the people who are planners or landscape architects who are at this Workshop is that when you go to your professional meetings where the whole audience are planners and landscape architects, that you carry these kinds of messages. Prepare a talk that illustrates some of the more difficult land-use issues besides the ones that may be more common in your industry.

And I comment to Mr. von Achen, one of the comments you made was that someone needs to demonstrate they have some other permits in place. That's often a Catch-22 because there is always a question for a new producer at which level do you begin the permit process. If you start at a level that's too high, the local people may be offended, figuring they've been caught in an end run, and if you start at the local level, some of the argument is, "Well, you haven't even obtained the necessary permits from the State." So, I would suggest that maybe part of the product from the Workshop here is that there is some kind of direction or suggestion of where do you start, at which end, or in the middle. How do you start that permitting process?

J. Kurt von Achen:

Your comment's well taken. And I agree that it is somewhat of a Catch-22. But when you get to the local level, unless you have at least made the contacts and know the requirements of the Water Resources Board and the State Historical Society and others who are interested in this and that have some control of your permit, the local people are probably going to cause you to stop and wait until you go to those folks.

Kent M. Bratton:

We'll physically tell you to start with us (the city planners) because we feel that in the end, we're going to be most affected. We might issue that permit contingent on approval from the other permitting agencies, because, by and large, we know who those people are.

H. Lyn Bourne:

I recognize that it varies from community to community and State to State, but I think that that's an issue or topic that should come out in the publication.

Kent M. Bratton:

We tend to like to keep our folks at home informed as well, so that they don't hear from Jefferson City about someone applying for a permit they knew nothing about.

Robert L. Pinkerton:

I would like to comment on one of the things that was mentioned here: "Why don't the planners include the valuable resources in their comprehensive plans and try to protect them?" That's a real good observation and a good comment and a good challenge to us. I'll tell you one thing that does happen, though. About 20 years ago, the Martin

Marietta Corporation, up north of Peoria, had a major, high-quality gravel and sand operation that was just about depleted except for that portion of the deposit which went under a community, Chillicothe, Illinois. We took a look at that. Martin Marietta said they weren't really sure what they could do. We suggested that they buy out the town, and that sounded kind of idiotic. In fact, the community might have been better off in doing that, and then that deposit could have been protected. When you get into central Illinois, oftentimes there are not good-quality sand and gravel deposits. That was one of the fears that we had. Of course, to the local politicians, that was not a priority. They looked at the existing sand and gravel operations as an eyesore next to the town, and politically it wasn't acceptable to talk about anything like that. Not even coming up closer to the town and doing something aesthetically desirable for the community in the long run, such as a reusable asset of some sort. So, the priorities of the local communities come back upon the planners. They (the communities) really make up our budgets and make decisions as to where we can go and what we can do. And quite frankly, mining is not a very interesting thing to most politicians, unless they are involved somehow economically or can see that it can be an economic resource to that community.

I'll tell you one thing that my organization did a couple of years ago. We did a study on the brick and tile industry in southwestern Illinois. Our Illinois Geological Survey helped us with this, and we located the deposits that could be minable. Our intent was to try to reestablish an industry which had gone down. If you had a chance to look around the older part of St. Louis, you will see that most of it is masonry. It's not masonry because of the ability of the area to provide good-quality clay; it's masonry because the unions were so strong they had it built into the city's law, until just 20 years ago. But when the law was changed, the industry left.

The bottom line of what we looked at in our study was to try to use this resource, which was in southwestern Illinois. There were arbitrary things that we couldn't deal with, like back freight-hauls into Illinois from the south, like the foreign ownership of long-term investments, and like air pollution. We couldn't build a facility in two of our counties because, air-quality-wise, the standards already are nonattainable. And we couldn't overcome the cost of making a facility meet the standards and be competitive with outside brick.

So, some of us do take a look, and some planning agencies do get involved with these kinds of things. Quite frankly, it would help us a lot if you would bring the problems and plans to us. If you are in our area, bring them to us. Bring them to a planning staff before you make an application. That's the best possible thing to do. And that's the way I think my staff feels most comfortable in working. We can maintain confidentiality, at least my agency can, and in Illinois you can. I don't know about the other States.

Robert S. Joice:

I would like to make one other comment on the educational side that I think would be valuable for both planners and geologists. If you, the industry, want to educate planners, come to a national planning conference, suggest to the American Planning Association staff that there be an item in the conference regarding quarries and mineral issues and pursue the issue directly yourself, as well as with planners and planning directors who are knowledgeable about geology. Particularly contact the APA in Chicago regarding the May 1993 national conference to be held there. [Editors' Note: Examination of the APA conference programs for the 1992, 1993, and 1994 meetings did not identify any sessions that dealt with mineral resources or mineral resource problems.]

Anthony M. Bauer:

My comments earlier were not directed to any particular individual. I am pleased to see that we are talking to some geologically trained planners, but you are not the norm, so my comments about the lack of understanding of the industry by the planning people still hold as a general rule, and I think you would have to agree with that.

A couple of comments that were made earlier about resource protection really apply to what I would like to say. I preface my comments by saying that in no way am I against the need for reclamation. If anything, we need stronger enforcement. We need to have tighter regulations in some respects, and in other respects develop more realistic regulations related to the specific characteristics of the industry and the geologic formations.

Most communities have regulations relating to the mining of mineral resources and to reclamation standards. But few have developed resource *protection* regulations, regulations that protect the resources from urban development and encroachment. I would like to cite two rather significant exceptions. One is the State of California in their SMARRA, State Mining and Reclamation and Resources Protection Act, whose primary purpose is to identify where these resources are threatened by urbanization and where critical needs for construction aggregates exist. These are obviously near and around urban areas. As most of us realize, the construction aggregate industry is an urban land use. Aggregate mining is located on the perimeter of urban environments. Another resource protection example recently adopted is in the Province of Ontario.

There are two basic objectives of both of these regulations. First is to identify the resources. The second objective is to get local communities to insert into their planning process "mineral resources need consideration." The regulations do not dictate that resource-bearing lands be set aside, but they require local communities to consider, as a part of their planning process, the need for and location of mineral aggregates. In some cases, mining may not be appropriate. But in other cases, it is a very appropriate land use. As we all know,

resource location cannot be manipulated or relocated to fit "ideal" plans. They must be obtained where nature placed the materials.

The key point here is that there is as great a need to protect resources from urban encroachment as there is to regulate the extraction of these resources.

Let me cite two situations why this is becoming more and more important. A couple of years ago the State of Maryland undertook a study of their mineral resources. They found that 90 percent of their reserves are lost to urbanization and urban regulation. Denver has projected about 10 years of accessible reserves. They have lost about 20 to 30 years of actual reserves to urbanization. Their next resource base is in the mountains. The argument for not allowing mining in the urban areas is protection of the environment. How is mining mountainscapes a more effective way of protecting the environment? There is a need for the planning profession, for the mining industry, for government officials to get together and begin dealing with this increasingly serious problem of resource depletion.

J. Kurt von Achen:

I think that's a very good point. We haven't done a good enough job of reserving those resources in our part of the country. However, sometimes your producers shoot us all in the foot. There is a case of two well-known producers who assembled rather large tracts of land close to each other. One of the producers decided that instead of mining, he could have a high-class residential development and make more money at it, I assume. So now that producer who is now a developer is fighting the other producer who wants to open a mine. Come on, guys, let's get it together.

Robert S. Joice:

I would like to raise the following as a question, and it's based on the previous comment, "Do agriculture and mining mix?" I mean a lot of planners are doing well if they can get any agricultural preservation on the urban fringe. Mr. von Achen made the comment about 5-acre residential lots being the majority of the development in what was rural Douglas County [Kansas]. That's a major issue, and planners across the country try very hard to control the suburban sprawl. It seems to me to be very directly related to the mining issue; if there can be better control of the sprawl, there probably could be better preservation for mining. The question I'm asking is, "Can there be a good alliance of mining and farming, or is there really a problem that some ordinances are too closely allied with farming?"

Kenneth W. McNichols, Director, Iowa Limestone Producers Association, Des Moines, Iowa:

I'm the Director of the Iowa Limestone Producers Association, but for the record I'm not here to talk on behalf

of the Limestone Producers Association. I'm here also as a grandfather and to speak for the generations that succeed us.

I was born and raised on a farm west of Des Moines, Iowa, in Madison County. The farm was adjacent to and part of a quarry operation, so literally I tell people that I was born in a rock quarry. As I grew up and went through high school, I worked in those rock quarries. When I went through college, I continued to work in the rock quarries. I graduated from high school in 1954, and between 1954 and 1960 when I was getting my formal education, there were approximately 200 people that worked in the quarries in Madison County, Iowa. At that time, Iowa did not have a land reclamation law. We were one of the first ones to develop a land reclamation law and part of the reason was because of the dastardly deeds that our forefathers did in wasting the land for those quarries and coal mines across the southern part of the State. They did nothing. They left giant spoil sites. It was bad. The people in Madison County were emotional. They developed local zoning before Iowa had a reclamation law that literally ran the quarries out of there.

In 1954 there were 200 people working the quarries in Madison County; today there may be 10. There are no full-time quarries left in that county. The Des Moines market that was served by Madison County limestone had to find another source. The point I want to make here is that it seems to me that through the U.S. Geological Survey, the Iowa Geological Survey, and the other State geological surveys, one of the things that we need to be working for is the orderly extraction of minerals. We need to have some sort of a governing body in each one of the States, some sort of a board of appeals, some sort of a board of review that we can go to when Mr. Zoning Man says, "No, you can't quarry anymore in Madison County," or "Because that's prime farmland you can't expand the boundaries of your present quarry." Local zoning boards should not be the final say when it comes to the extraction of minerals.

Unlike the gas stations that you regulate in zoning, and unlike the housing developments that you regulate in zoning, and unlike the urban sprawl that you regulate in zoning, mineral extraction boundaries go beyond that. Mineral extraction is not limited to the local community as were the other examples I mentioned. Local mineral extraction affects a much larger segment of our society than just the local community. I think it's just a real shame we put so much power in the local zoning board that they can shut down an industry forever. When a local zoning board is given sole power, they, in essence, can and do stop competition. In Madison County, do you think the extraction companies that were there wanted anything different? The existing companies are nearly always "grandfathered in," so they support tough zoning. They don't want another company to come in and set up. That's competition, and the "grandfather" clause plays right into the hands of the local established companies.

This is why I think that we have to have some sort of an outside court that we can go to when it comes to mineral

extraction, and that doesn't only need to happen in Iowa. California, as mentioned here earlier, is one of the first States that I understand that has done this. I think the U.S. Geological Survey would be very worthy to work in that direction. We need this. I don't need it, and the people in this room don't need it, but our grandchildren certainly need it. If there is going to be any competition or any free enterprise system left in the aggregate extraction industry, we must not allow local zoning boards to totally control the orderly extraction of subsurface minerals.

Robert L. Pinkerton:

You're dealing with apple pie and God and everything else now. One of the most cherished things in the Midwest is that local land-use decisions be made by local government. It may not be true on the West Coast and certain other places across the United States, but it is in the Midwest and particularly in Illinois. There is a constant battle in the Illinois Legislature, involving whether or not the State should do something, and the local governments are saying, "That's our responsibility. Don't you dare fool around with that." Now there are some major exceptions and they have always started with initiatives at the Federal level. Solid waste, for instance, where EPA forced the States into implementation of pollution control standards, resulting in the State of Illinois now having oversight responsibility on solid waste locations. That's a big, messed-up area to talk about and the rules are changing constantly. In Illinois, the Legislature, in their infinite wisdom, gave the State Pollution Control Board the responsibility for determining where sites for solid waste disposal (landfills) should be. That went to court and out of that came joint decision-making with the local governments. So what I'm saying is that in Illinois in particular, and I know it's true in Wisconsin to some extent, because I practiced there, that the business of local decision-making, local governments making land use decisions, is a very cherished item.

J. Kurt von Achen:

Quarry applications that are put together in a good manner usually win. The local planning and zoning boards are usually looking for reasons to grant your request. It's the applications that are flawed, it's those that don't follow the rules and regulations that aren't going to make it, and they shouldn't make it. But you also have what you're asking for; in Kansas it's called the court system. You may challenge that local decision in District Court.

Robert S. Joice:

Finally, I would add that it is important for planning commissions, both staff and planners, through the planning process to fully consider the information to protect the resources, etc., to make responsible decisions. Granted, it

may be that a poor decision is made, but I disagree that mineral resources are very much different than an industrial plant. You need mineral resources if you want to grow, if there is a large industrial plant going in, or a regional shopping center, or some other facility. If you would like to debate that, go ahead.

Kenneth W. McNichols:

The problems exist, and again, not with just the local zoning people. I appreciate what you're trying to do. We all sit on boards where we have responsibility to do these things. But the problem exists in State laws that do not recognize the need for affordable minerals. Madison County and Polk County in Iowa adjoin each other. Now Madison County says, "We consider this prime farmland. Polk County is primarily Des Moines, that's urban. We don't like the idea of shipping all this aggregate to Des Moines. It's going out of the county." What I'm saying is wrong [Editors' Note: Refers to current jurisdiction over mineral development], is the very border of what we call the local government. When it comes to minerals, I don't think we should be looking at those county lines. Society's need for minerals doesn't stop at the county lines. In those instances the county lines don't mean a thing. For all the other things they do, the zoning board regulates, but they don't have anything to do with where God put that mineral.

Robert S. Joice:

The jurisdictional line—it's the exact same issue if Toyota is going to relocate 3,000 jobs in Fayette County or if they are going to locate in the county next door.

Kenneth W. McNichols:

It's *not* the same thing, because those people could transfer back and forth. You can't take that mineral deposit and transfer it. I heard somebody say a little while ago, we could economically transport minerals up to 100 miles. I've been in the business long enough to know that when you transport limestone you double the quarry cost about every 25 miles. Now does that make it economically feasible? Does it make sense to make it four times as expensive 100 miles away just to get by local zoning?

We can do this together. We have the technology to extract these minerals and to provide jobs in these areas that zoning officials want to protect. In nearly every case we can extract the minerals in a fashion suitable to the neighbors and return the extracted land to the community in a condition as valuable as or even more valuable than before extraction.

Valentin V. Tepordei:

Just a comment about local responsibility and local power to award mining permits. California is the only State

in the Nation with four State trade associations, because the mining permits are granted by the county governments. The State has only an advisory capacity. The purpose of the California Surface Mining and Reclamation Act is to plan for long-range use of the State's natural resources. Of course, the mining permit, in the final analysis, will be your and the County Planning Commission's responsibility. But the planning for the long range should be done at the State level, because if you start planning at the county level, you are not going to care about the county next door. You are going to care only about your county. Unfortunately, your aggregates cross the county lines both in location and in markets. You have to look in a broad range to see the broader picture as the State does. That's what the industry needs, long-range planning for mineral resources.

William V. Bush:

Local planners used to recognize that industrial mineral resources are not always used in the local area. Others may be dependent on their resources, just as they are dependent on resources from other areas. The "not in my backyard" syndrome is not a valid excuse just because the commodity is not being used locally. A planner in another State might be struggling with a decision on an industrial mineral site that may benefit you locally. I think the gentleman [Mr. McNichols] made a good point that these commodities have to cross local boundaries.

Robert S. Joice:

Frankly, the "not in my backyard" syndrome is something that is affecting planning across the country, and it's affecting it in all sorts of ways, whether it is a halfway house or a quarry or whatever. It's a problem that is difficult for planning organizations to deal with. And frankly, there are occasions when citizens go too far in trying to prevent all sorts of activities that need to take place.

J. James Eidel:

Let me emphasize a point we've been making. Mr. McNichols basically said that mineral resources may be only in one spot on this Earth and you may not find them somewhere else. Unlike all the other resources or all the surficial uses of land, they can't be moved, and that's very true. Mr. von Achen said that planning commissions needed the facts in terms of making a decision. Well, I think maybe the answer from this deliberation is that the mining industry or a State [geological] survey should bring the facts to the zoning commission about where the resource is and where the resource isn't; then they could evaluate those facts and the competing uses, and say, "Fine, we have no other place to get this material, so then the use should be in favor of the mining

company.” And those facts on mineral resources are the facts that are found on geologic maps.

J. Kurt von Achen:

That’s exactly right. That’s what we’re asking. Give us the ammunition so we can make a decision that is essentially against the neighbors, but for the good of the whole community. Unless you bring that to us, we’re stuck.

Aldo Barsotti:

A comment. Some of these companies you talk to that you give permits to mine, they’re mining because they are in business to produce rock, but that rock that they’re talking about is used locally, it doesn’t go very far, and that may be something you might want to take into consideration. And that’s part of this planning process that Jim [Eidel] was referring to. We need to have *more* information taken in a *broader* perspective to give to those people who are making decisions at the local level as well as the State level.

Bruce H. Mason, Executive Director, Indiana Aggregates Association, Indianapolis, Indiana:

I would like to reinforce a few points that were made.

It’s exceedingly difficult for any one company to come in and identify mineral resources in an area. It’s equally difficult to get the attention of what I call the “public policy makers.” Maybe we need to start at the Statehouse or at the Geological Survey or a combination of both. But there is a definite need for a public policy to protect mineral resources for use by future generations. Individual companies can develop and profit from those resources, but society has an equal need to have access to those resources so that basic needs of society can be met.

In my professional history, I have had the opportunity to work for a government agency and for private industry. I also have held elected office and have chaired those “tough” meetings where people seemed to worry more about minor things such as whether franchise cable TV is going to be approved rather than whether their “trash” is going to be picked up.

The public has an unrecognized interest in having access to cheap, “quality” industrial minerals, whether it be aggregate or some other industrial mineral. The public will need these resources to continue to enjoy civilization as we know it today. There seems to be “nobody home upstairs” who is willing to take on and develop those public policies.

Somebody has to ensure that the resources needed by society are there for public consumption. I must confess that I don’t know how to start that process. I am frustrated as an individual and as a professional in trying to get this need recognized in my own State. I have worked in other States and have been equally frustrated because the same problem

exists in those States. If we’re talking about other resources, such as trees and wildlife, something might get done. When it relates to mineral resources, “It’s too close to our backyard.” The resources are there for everybody to use, but we are limited in our ability to develop and use those resources. We just can’t seem to get it done.

Robert L. Pinkerton:

I think what we’re really talking about here are competing objectives. Because, obviously, we have a need for resource minerals in our day-to-day life. We have other interest groups, and this is a special-interest group here. You’ve got competing interests and objectives, for example concerning the mines near Columbia, Illinois, and you’d be surprised where these are coming from. We have interest groups in Illinois that don’t want to see anything scarred up in the way of removal of the bluffs that are around here, which is where some of our mines are. And they’ve been able to get certain laws or policies enacted by the State of Illinois. The pressure is coming from a whole variety of places, and I’ll guarantee you, it’s getting worse. There are so many laws on the books now, that I don’t know how local governments are going to effectively be able to deal with them. I mentioned the LUST program. Well, we’ve got an Historic Preservation Agency that deals with land disturbance. If it’s a Federal or State project, you’ve got to do an archeological study. We have preservation of agricultural land, maybe in direct competition with a minable resource. And believe me, in the State of Illinois, our Department of Agriculture is paying a lot of attention to that particular objective. We have the wetlands, we have all of these kinds of things to deal with that we did not have 10 years ago. So the cost of doing business is going up, the complexity is going up, the time required to get something done is going up. I appreciate the efforts of our volunteer planning commission chairmen around the State to try to pull all this together in some sort of public local policy decision making.

Timothy S. Hayes:

That was a very good discussion, about exactly what we were hoping for at this meeting. Let’s start a discussion now on Economics with Panel 3: Cost factors in industrial minerals use. The panel leader is Dr. Subhash Bhagwat, Mineral Economist with the Illinois Geological Survey.

COST FACTORS IN INDUSTRIAL MINERALS USE

Panel leader:

Dr. Subhash B. Bhagwat, Mineral Economist, Illinois State Geological Survey, Champaign, Illinois.

Panel members:

George E. Dirkes, Executive Director, Illinois Association of Aggregate Producers, LaGrange, Illinois.

John F. Schmidt, Vice President and Treasurer, Columbia Quarry Company, Columbia, Illinois.

Louis Griesemer, Griesemer Stone Company, Springfield, Missouri.

PANEL PRESENTATIONS

Dr. Subhash B. Bhagwat:

After this very lively session where the topic touches everybody very closely, we are coming back to some of the mundane issues of dollars and cents.

We have three very experienced panelists here and so I'll keep my remarks to a very brief 2 or 3 minutes and leave it to the panelists to take the issue up and outline some of the things that are on their minds.

We will talk about the costs or factors that affect the cost of industrial minerals. We basically talk about two different areas where the cost can come from, some that are related to the industry itself, and others that come from external actions or regulations that the industry has to deal with. I'll briefly go over them.

Availability of resources is an internal factor that we had ample discussion about this morning. Labor relations have not been discussed too much as of now. But that's a factor that one has to deal with in differing amounts in every industry. Cost of extraction. There are plenty of people here to deal with that. Cost of transportation. This was mentioned before as a commodity, especially in the industrial construction aggregate industry, where the unit cost is so low; commodities are very sensitive to transportation costs. And then there is the competition both at the national and local level, as well as at the international level in certain cases. Believe it or not, aggregates coming in from overseas are known on the East Coast.

As far as external factors go, we have Environmental Impact Statements, we have other factors such as the ban on CFC's; that doesn't affect the construction industry but does affect other industrial minerals such as fluorspar. We have another area, urban growth and zoning, we've just had a lively discussion about that. Population densities. Something to take into account while planning, especially long-term planning. Where are the high population densities? How are they developing? What are the anticipated needs 10, 20 years down the road? Economic growth is a fairly generic type of factor that does have some local implications, because the construction industry can move or go bust in local areas while the national economy is still growing, and vice versa, so you need to take that into account. Taxes and subsidies may not have that much effect in a discriminatory way as far as local construction industry goes,

but they do matter when it comes to competition between States or on an international level. And, finally, a factor that is bound to have increasing importance in the long run and that is material substitution, materials that do not come from traditional sources of mining, they may be manmade materials replacing some of the traditional materials, but, ultimately, we still have to look at the raw materials used for those manmade materials.

So we are looking at two major groups of factors, and with that I will just leave the field to George [Dirkes] to take up and to outline some of the things that he has in mind.

George E. Dirkes:

Most people not acquainted with our industry associated our costs only with operational expenditures, like payroll, equipment, and maintenance. Even some of the people in industry are not acquainted with the many more costs, the real costs of producing construction aggregates. One of our earlier speakers today felt remiss in that he was preaching to the choir, but I welcome that. Our people should know all our cost factors. There are only 12 of us, I think, in this room that are actively involved in the aggregate mining business; the rest are in various forms of government or other parts of the bureaucracy. Therefore, I have a message to present to them today.

In preparation for today, I decided to make a list of major components that make up our cost factors. But after I constructed the list, I decided to group it and dissect it, try to get it in a little more meaningful presentation, whereby we can learn something from it. There are some things to be observed here (table 8). I want to say that at best, the list is only a good start.

You will notice that expenditures are divided into three categories: high-risk, pre-production, and operational expenditures. Then, to the right, are four columns, one-time, occasional, continual, and uncontrollable expenditures. The plan is to analyze the cost, where the money goes, if you were to start a pit or a quarry. Most of the items are listed in chronological order; however, sometimes in the real world, one can get in front of the other.

I wish to point out that as you go down the list and read all the items upon which you are going to spend money—you don't begin making rock until you get to the bottom of the list to operational expenditures.

HIGH-RISK EXPENDITURES are those expenditures that are incurred before you get the green light to produce; i.e., these expenses cover the cost of finding a deposit, proving it up and obtaining your permits from the various levels of government. Associated with these costs are expenses for specialists such as engineers, lawyers, scientific and lab people, and, lastly, what it costs when you buy your money. You may very well spend money in each one of these pockets and still get shot down. That is, the final testing may prove the piece of property you are looking at does not

Table 8. Factors affecting the cost of industrial minerals.

	Expenditures			
	One time	Occasional	Continual	Uncontrollable
High-risk expenditures:				
Geological	x	x		
Financial	x	x	x	x
Exploration and testing	x	x		
Legal	x	x	x	
Real estate or royalty	x		x	x
Environmental (discovery)	x	x		
Permits	x	x		x
Engineering	x	x		
Pre-production expenditures:				
Stripping	x			
Plant site prep	x			
Plant and equipment	x			x
Build plant, shop, etc.	x			
Operational expenditures:				
Production and maintenance			x	
Environmental control			x	x
MSHA			x	x
Sales			x	
Public relations			x	x
Reclamation			x	x
Waste material			x	x

contain enough material to be worthwhile or the material may not be of suitable quality. You may also get shot down in the permitting section. You may not be able to generate enough profit to meet the State and Federal environmental requirements. If you are in a situation where there is county zoning, you can get shot out of the water at that point also. Lastly, if you need to borrow big time money to get going, your banker may not feel that there will be the proper return on investment to pay off your debt because of your price structure. Since you can lose the ballgame at any time during this first category of expenses, that is why I call this group "high-risk expenditures." If you don't get the green light, you lose all money invested up to that point and all you get is a tax loss—which is worthless unless you have a profit to put it against.

PRE-PRODUCTION EXPENDITURES: If all that is green, then you go into the next set of expenditures. Pre-production expenditures are that set of expenses you must undertake after you have been given the green light. Those

expenses are readily understandable. Stripping, plant site prep, plant site purchase, then you have to build the plant, the shop, the office, scale house, etc., etc. They are one-time expenditures in a normal operation, but this money must be spent before you shake out the first rock.

Finally, we get to production. **OPERATIONAL EXPENDITURES** are those expense items associated with the making of rock products. In the old days, 30 or 40 years ago, we were usually only concerned with two expense areas—production and maintenance and sales and overhead. Here I'll include taxes. Taxes are big enough that they could be a separate item, but taxes should be considered as part of production and maintenance. Today the list is considerably longer through the inclusion of additional items that have been laid on us by the government over the years. Environmental control costs money. MSHA costs money, but probably is a good expenditure because most of the time the MSHA are trying to protect the employee and we're all for health and safety.

Not much money is spent by our industry on R & D expenses, and public relations expenses. Our industry is sadly lacking in public relations expenditures. This year we are stressing it very hard in Illinois. Something is going to have to be done. Every speaker today, no matter what subject he spoke of, talked about education, education of the regulators, education of the community, and all that comes under public relations.

Reclamation is an ongoing cost that starts when you do your stripping. You put your stripped overburden in the proper place and it becomes part of your reclamation program.

I conclude the list with an item that many people seem to overlook, waste material. Waste material generated has to be factored into your cost. If you get 80 percent saleable products out of your operation and 20 percent waste, the cost of production for the saleable products has to then be increased by 25 percent to accommodate the expense of generating waste material. I wonder how many of our operators think that way.

All these expenditures can be classed conveniently on the basis of frequency of occurrence. In the one-time expense column would be an item that, obviously, only occurs once, like site preparation. Some items can occur more than once; these are classified as occasional expenses. A good example would be the expense for environmental discovery. That cost item means that you hire an engineer or environmentalist or some such person and they discover and file for you all the various environmental permits that are needed in order to operate. Normally, this would be a one-time expense. However, because those laws and regulations keep changing, keep being added to, you may on occasion have to seek such professional help again. Some items have every column checked. For example, legal expense. One would hope that you would only have to hire lawyers at the onset of your project, a one-time expense. However, the

way things happen, you may have to go back to the lawyer a few more times; that would make it an occasional expense. Unfortunately, it seems that we are turning to the lawyers more and more these days. Therefore, it could very well get in the continual expense column. Ditto for the banks and ditto if you don't own the property and are buying your mineral on a royalty basis.

At the far right of the table is a column called uncontrollable expense. This column is probably arguable, but it includes those expense items over which you have little or no control. Example: The cost of money. You can shop your banks, but usually the cost of money is pretty similar. Unfortunately, most of the uncontrollable expenses are rising.

Not included on this list is research and development because most of the individuals in our industry do not spend any money on such an item. Because of the price at which we sell our product, there is not a whole lot of money left over after normal profit for the opening of a replacement pit or quarry—let alone research and development or public relations. It is my opinion that in respect to pricing, many of our operators are sawing off the limb upon which they're sitting; they sell too cheaply. The end result is that upon depletion, companies simply go out of business. Or, as depletion nears, many companies sell out to larger companies because they can't see their way to bankrolling a replacement pit or quarry.

The price structure of our products determines the amount of money that can be dedicated to a reserve fund for replacement expenses. Unfortunately, over the years, many of our producers have been lulled into a false sense of security by the good market volume the industry enjoyed as a whole. There are several things that have to be taken into account that will affect this conclusion. One significant change over the past 30/40 years is that there are many additional expense items that weren't there one generation ago. Expense items such as those which occur as a result of the rules and regulations promulgated by government are a significant expense. Add to that what happened to the cost of the various insurances over the past generation, and you can readily understand why you cannot look at the replacement costs for our operations in the same way as before. Things have changed dramatically. Getting your hands on a piece of real estate that contains mineral is only part of the economic situation. One generation ago that was most of the economic equation.

One of my observations regarding pricing is that in the past 30 years, our prices did not increase in keeping with many of the common things that make up our daily lives. For example, here are six common items and what happened to their cost over the past 30 years. The exact amount of the increases is open to argument. With the help of one of our major companies, I have determined that the price of our product has risen only approximately 250 percent over the past 30 years. This is on a generalized basis for all products averaged together. During that same 30 years, the cost of an

automobile has risen 500 percent, labor has risen 600 percent, homes have risen 700 percent, the cost of football and theater tickets has risen 800 percent, cigarettes have risen 900 percent, and the cost of a loaf of bakery bread has risen about 1,000 percent.

Those numbers relate to our daily life and our quality of life and also relate to our margin of profit. The figures for labor and automobiles can certainly be correlated with our industry, as the increase in the cost of an automobile should, in general, have some relationship to the increase in the cost of our equipment. If you study these numbers, it appears that there is a paradox, how can equipment, labor, and services rise at a rate that is two or three times greater than the rise in the cost of our product and yet we are still able to stay in business? Part of that answer lies in the analogy that I made earlier about sawing off the limb we are sitting on. Many of our smaller and medium-sized companies do not have the reserve funds they used to have. Many of these same companies do not have any surplus funds for items that I consider necessary, such as community relations and R & D. There are mitigating factors that would also explain this paradox—at least explain it in part. One is the fact that the volume produced by our industry, as a whole, has increased significantly over the past 30 years. Therefore, we make less per unit but sell more units to derive some total profit. It is the philosophy of that equation that creates bigness of producers and causes the demise of smaller operators. The philosophy of producing more-for-less has an end point in classical economics. When that end point is reached, the more-for-less advantage is gone and the pricing structure must be adjusted upward. In the interim, while the marketplace is seeking that point in time of adjustment, many suffer because of financial restraints.

Our own industry suffers from the lack of R & D in two areas, R & D on our products and R & D for the equipment we utilize. With regard to R & D concerning our products, I have good news and bad news. The good news is that the IAAP (Illinois Association of Aggregate Producers) does have an ongoing R & D program in place and our first research product under this new program is underway. Similarly, the National Associations are undertaking a significant effort for a joint-venture R & D program. The bad news is that this may be too little too late. Already there are ominous rumblings that the superhighways in Europe are far superior to ours. That comes as a bitter pill since most Americans think that we are leaders in that area. With regard to R & D concerning the equipment we utilize in the production of our material, my observation is simple. The equipment industry is in the same kind of situation as the aggregate industry, hurting for profits. Because of that, R & D has suffered. In essence, with regard to our equipment, all we are doing is making it bigger. It is this bigness that has helped the industry survive the disparity of cost increases, when you use an 80-ton quarry truck instead of the 20-ton truck of 30 years ago, you save the expense of three operators.

However, like most things, there is an end point to the bigness solution. Not everybody's operation will lend itself to a large quarry truck. The smaller and medium-sized operators who are suffering from the price equations cannot turn to bigness or high volume as a solution for their problem. Most of these small and medium-sized operators are a needed part of the supply network. When they are gone, they cannot be replaced by a large producer. A large producer cannot survive on their low tonnage. Therefore, when that day comes, the material will have to be shipped in from greater and greater distances. Hence, at that point, the cost of aggregates in that area will go up—not because of the price of aggregates but because of cartage. When the small and medium-sized operators are gone, we have eliminated the basis for competition.

John F. Schmidt:

I won't belabor all of the various cost factors that Mr. Dirkes has hit; however, one thing that needs mentioning and that has impacted our cost is the trend to smaller aggregates. Most of the products specified by highway groups and engineers today are 1" or less in size. In crushing our limestone down to 1" minus, we make more dust, agricultural limestone. Our market for aglime is limited at best. It used to be that we'd get an exceptionally good aglime sales market every 10 or 12 years, but it now has been much longer than that since we've had one. So we do have unwanted byproducts that result from making our prime products, that add to the cost of the prime product.

We have gotten increased competition from a new area in the past couple of years and it's growing—that is the competition from recycled asphalt and concrete. Certainly recycling is desirable, but for those who are in the virgin product industry, it does cut into our market.

In the area of quality control, we are experiencing increased costs, as the State of Illinois is introducing a quality assurance program that requires the quarries to do the testing that heretofore has been done by State inspectors.

Over and above our quarry costs, the item of transportation has been mentioned any number of times. When I started with the quarry back in 1952, about 70 percent of our products moved by rail. Today this figure is less than 10 percent. In the fifties and sixties, the railroads would grant special rates for road jobs so we could use them to ship our products as there weren't as many quarries around the State. The railroads are not competitive for our business today, unless it's something in trainload quantities where we can move the same cars back and forth on a regular basis. With the advent of better highways, the interstate system, and increased load limits, the majority of our products are now transported by truck.

I asked one of our haulers to give me some comments on the primary factors that affected his costs. For simplicity and brevity, they are listed as follows in outline form:

- I. Distance
 - A. Actual road miles traveled from aggregate source to job site and return (round trip mileage)
 1. Mileage from truckers' garage to quarry
 2. Mileage from job site to garage at end of work day
 - a. fuel cost
 - b. wages
 - c. equipment wear
- II. Volume
 - A. Routing
 1. Interstate highways
 2. State highways
 3. City streets
 - a. load limits
 - b. power lines
 - B. Deadlines
 1. Loading hours and dumping hours per day
 2. Minimum tonnage per day
- III. Volume
 - A. Regular haul, systematic (i.e. asphalt plant-batch plant)
 - B. One shot deal
 1. Parking lot
 2. More than one-day job
- IV. Product
 - A. Riprap
 1. Rough trailers
 - a. usually heavier
 - b. less pay load
 - c. easy to turn over
 - d. loading in pit
 - B. Aglime
 1. Wet down
 2. Tarp
 - C. Manufactured sand
 1. Tight tailgate latches
 2. Taping inside of gate
- V. Gross revenue
 - A. Minimum \$44.00 per hour
 - B. \$350.00 per 8-hour day
 - C. Overtime
- VI. Specialty service items
 - A. Tailgate load
 - B. Dumping in spreader box
 - C. Multiple dumping of a load
 - D. After working hours loading
 - E. Saturday loading

There are no doubt other factors that have been omitted in this pricing logic. However, this schematic should give one some ideas about what goes into the mix that ultimately determines a freight rate.

Louis Griesemer:

I'm an area manager for three separate companies, for the Griesemer Stone Company in Springfield, Missouri, whose underground limestone operation has been in continuous operation for 45 years in the same location, for the Joplin Stone Company in Joplin, Missouri, where a surface pit has been in operation for 27 years, and for the Parkville Stone Company in Parkville, Missouri, where there is an underground operation.

I think one element here needs a little more emphasis and that's the cost of public relations. I know a little bit about those tangible and intangible costs. For 40 years we didn't do any public relations and then we went to a zoning case about 3 or 4 years ago. We thought we were doing a real good job. In Springfield, Missouri, we had a nice underground operation. We used to kid about being a low-profile company. We found out just how low profile it was when we got to the zoning hearing and found out nobody in town knew what we did. That turned out not to be a plus.

In order to turn that around, we've started over again with some basic advertising and community relations, a lot of tours for school groups, Cub Scouts, whoever wants to come in. We certainly encourage them to come in. One of the problems with being a producer, we don't think much about public relations because our customers are almost captive customers. We don't do a lot of advertising to bring in members of the general public. The general public are not our direct customers, they are indirect customers. We are selling products to them through asphalt and through concrete plants. They don't really know where that material is coming from. We don't put our names on newspaper ads saying what we sell, and, "Come in and get a load of gravel," because, like a lot of quarries, we consider pick-up trucks to be a nuisance out on the lot and sometimes a hazard. So, when it came to the type of public relations we go after, most of ours are public service announcements. We support the PBS station in Springfield, Missouri. On Tuesday evenings, if you watch the McNeil-Lehrer News Hour, you'll see that it's brought to you by Griesemer Stone Company. And we added a line at the very end of the announcement from the Missouri Mining Industry Council, "If it can't be grown, it has to be mined." Just a very basic statement, trying to get our point across that the minerals industry is very important to the community.

If you don't think that point is missed, I would invite you to a quarry zoning meeting, where some aggregate producer is trying to get zoning, and see the misconceptions by the general public about what we do. I know there are a lot of operations that don't present a good face for our industry, and the good producers bear the brunt of that. What we need instead of all the headlines about the bad things that happen, we need to make the good things available to the public. There was talk earlier in another panel about the beautification contests, the landscaping contests at the national level.

Those stories are in our trade journals where they don't do any good in public relations. We are preaching to the choir. That publicity needs to be in the local papers, and we need to make more effort in getting those things down to the local level—get them out to the public who are going to go to the zoning and planning meetings. Then perhaps they'll see that there is a balance to these issues.

John F. Schmidt:

I just want to make one more comment. In the public relations area, the two national organizations that represent our industry, the National Stone Association and the National Aggregate Association, are sponsoring a public relations seminar, so it is something that is being addressed at the national level as well as the State level.

Dr. Subhash B. Bhagwat:

Most of the points that were covered here were cost factors that occur within the industry as Mr. Dirkes' chart shows, but there are a number of them which are imposed on the industry from outside. Some of the questions seem to be getting the same answer. Educate! Things that you do as well as things that you don't do come haunting us. I can tell you from experience that education is one of the things that pays, and the earlier, the better. Four years ago in my son's first grade class, I took a box of minerals and showed the kids what these minerals are and I did something similar to what Mr. Griesemer just said. If it has to be used, if it cannot be farmed, it has to be mined. I pointed out to several children what kind of minerals are involved in the things that were around them, and, to my surprise, it was the teacher who was more impressed than the kids, because she didn't know much about minerals at all. I guess I cannot overemphasize that factor of educating.

DISCUSSION

Marshall R. Thompson, Department of Civil Engineering, University of Illinois, Newmark C.E. Laboratory, Urbana-Champaign, Illinois:

I feel a little bit like a fish out of water, too. I'm a Civil Engineering Professor in Research and Education, primarily dealing with highway materials and pavement analysis and design.

I heard this morning concerns about the fact that we are depleting our highest quality materials. I would suggest that an option, that has been considered in the past and has proven effective, is to learn how to use lower quality materials that are more readily accessible to a project site. Therefore, material transportation costs are reduced. Unfortunately, as we move into using "off-standard" materials, it takes more engineering, more testing, etc. That is obviously a cost factor we have to consider.

A few comments relative to recycling. Recycling is here to stay, folks. I don't think that we're ever going to see anybody backing away from recycling. Solid waste disposal is a major hangup. There were times when they tried to declare asphalt concrete a material that you couldn't "put in a solid waste disposal area." I think even at this time, in some cases, that is a major problem and concern. I think that the aggregate industry is going to have to learn how to compete with recycled materials, whether it's concrete, asphalt concrete, etc. Recycling is a part of the scene that we are now operating in and it will have to be considered.

In terms of how to get dollars for research and development, product development, etc., I think certain things such as check-off taxes offer potential. At the University of Illinois in the agronomy area, we are fortunate in having moneys that are derived from a tax that is assessed against each bushel of corn and (or) soybeans produced in the State of Illinois. Now, if you folks get behind a program of that sort, you can generate funds for research and development, for public education, or for whatever the need may be. For example, in Europe it is not uncommon to assess a tax against highway construction to support a research and development program. In Belgium, there is a tax against each and every highway project, based on the price of the project, that goes toward R & D activities. I think these kinds of activities perhaps give us ways of generating support.

We are getting called upon to use crushed glass bottles in asphalt concrete. Right? There are all kinds of proposals like that around. And those materials are competing in the marketplace. In some cases, they aren't materials that give us the same quality you would like to have in high-quality construction. If we need higher quality construction, we may have to learn how to do it with lower quality material.

Dr. Subhash B. Bhagwat:

George, would you like to take a shot at that tax?

George E. Dirkes:

I would rather our producers raise the price and control the program and the money ourselves, than get into the hands of the bureaucrats, and then have them give it back to us as they see fit. I feel it would be a more efficient use of money that way.

Marshall R. Thompson:

I think it would be worthwhile to check in and see how the corn-soybean guys do this.

Curtis H. Ault, Mineral Resource Section, Indiana Geological Survey, Bloomington, Indiana:

A question for Mr. Griesemer. You're involved with underground mining of limestone and dolomite. Would you

care to make some kind of a generalization as to comparisons of cost for underground mining as compared to open pit quarrying in your experience?

Louis Griesemer:

We have surface mining in Joplin and underground in Kansas City and in Springfield. The costs vary more due to the geology than to the fact that we are underground or at surface. Generally when you're surface mining, you're taking off several feet of overburden, and that cost is offset in underground mining. Your labor costs may be higher underground, and your capital machinery costs also may be higher because you're dealing with more specialized machinery. Each of our three sites has unique costs; even the two underground sites are not strictly comparable. In the Kansas City area, for instance, we're roof-bolting, and operations in that facility cost more than in Springfield where we do not have to roof-bolt. So, it's very, very hard to generalize.

I'd say each site has its own specific costs. The nice thing about the cost of transportation being so high, is that it protects you. Everybody within the same area has nearly the same geology and has to put up with those same conditions.

In Springfield it would be very difficult for us to compete the underground versus open pit quarries. Fortunately, our underground working is right on the border of the city limits, which gives us about a 7-mile haul advantage over any open pits which cannot locate as close.

Let's talk about land use and compatibility. We have all types of zoning around us at our 400-acre site in Springfield, and we, ourselves, are partly industrially zoned and partly agriculturally zoned. We are a grandfathered mining operation. To the east of us is more agriculture zoning. To the north of us it is commercial-industrial, and to the south of us is a very, very nice residential area. We are blasting less than 2,000 feet from that residential area. Of course, being underground, we're just concerned with ground vibration and not air blast.

But we are developing the underground facility. We have 1.2 million square feet of underground storage, so we end up being our own worst neighbor. We have a lot of industrial customers in those facilities that we have to protect; they don't want blast damage to their structures, and we want to continue their leasing from us.

So, I think we can be creative in this industry, to be compatible. When we are talking about land use and protecting particular areas, I think we need to look at the geology of those particular areas to see if maybe an underground mining operation might be compatible.

I want to add a comment about the recycled materials. I don't see them necessarily as a competitive problem. I think that's probably an industry that we should be in as well. The "recycled" industry requires that there be some sort of stockpile lot which we already facilitate. Very often, we are

talking about blending virgin and recycled materials, so I don't see recycling as something that is out there against us. I think it is part of us. We are mining the highways, in effect. That's where the resource is, and that's where we should go after it.

H. Lyn Bourne:

One of the things that hasn't been discussed in the economic factors is profit. That may be too obvious, but a few years ago that concept was considered obscene. I think that it has been demonstrated internationally that the free enterprise system works better than some of the other economic systems. Profit is important, because if you can't demonstrate a profit, trying to win investors or borrowing money from a bank won't fly. So, in your list of economic factors that influence industrial minerals, whether they're aggregates or whatever, profit is important.

Dr. Subhash B. Bhagwat:

I think that's what Mr. Dirkes was alluding to when he said that, over the years we have been selling the shop, that the profit margins have been squeezed. I assume that was also the point he made in saying that he would prefer to raise the prices and have the money to do the R & D rather than give it to somebody else.

KEYNOTE ADDRESS

Midcontinent Industrial Minerals Workshop Banquet

September 16, 1991

Timothy S. Hayes:

For several of our Workshop members, our banquet speaker tonight is an old friend, just returning to the region. Chip Groat is a former State Geologist and Director of the Louisiana Geological Survey, and we have, of course, four other State Geologists or Assistant State Geologists here in our Workshop tonight.

Chip is now the Executive Director of the American Geological Institute in Alexandria, Virginia. AGI is the umbrella organization for 19 different associations of geoscience professionals. Common to all 19, and thus a particular interest to AGI, has always been the subject of geoscience education. Chip has a Bachelors Degree from the University of Rochester, a Masters from the University of Massachusetts, and a Ph. D. from the University of Texas at Austin, all in geology. Prior to his 12 years as Director of the Louisiana Geological Survey, he also served as Assistant to

the Secretary of the Louisiana Department of Natural Resources and administered Louisiana's Coastal Zone Management Program. Chip was an Associate Director, and Acting Director of the Bureau of Economic Geology at the University of Texas in Austin and then served 2 years as Chairman of the Department of Geological Sciences at the University of Texas at El Paso. He has also had some particularly appropriate experience as a geologist. He has consulting experience with talc deposits in the Trans-Pecos; zeolites in Coastal Plain volcanic sedimentary rocks; limestone, clay, and other nonmetals on University of Texas lands; and he has experience in Gulf Coast sand and aggregate resources. He has represented both Texas and Louisiana on the Interstate Mining Compact Commission. On the other hand, he has also been involved in studies of the environmental effects of mining and in mined land reclamation planning. Chip will talk to us tonight about the need for education about the role of minerals in our society, in a talk he's going to call,

"IF ONLY DICK AND JANE HAD GONE TO THE MINES"

Dr. Charles G. Groat, Executive Director, American Geological Institute, Alexandria, Virginia²

I am using that title tonight because I got to thinking about Dick and Jane and realized that there are probably many people out there who remember Dick and Jane. There are probably a few of you who are too young, maybe a few of you that are too old. Then I realized that there are some State Geologists here and I figured that there are also a few who haven't been to school. So, with that in mind, even with the various handicaps, I'm going to use Dick and Jane to paint a picture.

We remember, "See Spot. See Spot run. Run, Spot, run." I don't remember too much about Dick and Jane other than those little catch phrases that went on and on, but one thing I do remember in that primary school reader was Dick and Jane going to the farm. I don't now remember whether it was Farmer Jones' or Farmer Brown's, but I do remember the little pictures in the book, and you see Farmer Brown with the cows, and they would say something appropriate, "See the cows. See the cows moo." And out of that picture of Dick and Jane at the farm, the crops and the cows, the chickens, and Farmer Brown milking the chickens, and all the things that they do on the farm, you get this warm, fuzzy

²Current (1993) address: Executive Director, Center for Coastal, Energy, and Environmental Resources, E302 Howe/Russell Bldg., Louisiana State University, Baton Rouge, LA 70803.

picture of agriculture: how pleasant it is, how American it is, what an honorable profession it is. This is the backbone of our country. These are the resources we have to have to live—the food—and what better thing can a person aspire to than being a farmer? And so pastoral and important it was, that it made it into the Dick and Jane reader, as an example of what America was all about.

My teacher didn't tell me that to create all that farmland millions and millions of acres of forests and prairie land had to have their ecosystems destroyed, that untold populations of wild animals and wild plants had to be destroyed. That in the process of creating our tremendous agricultural system in the country, we created one of the worst erosion problems in the world, that we had the Dustbowl as a result of poor agricultural practices. And there was created in the Federal government, within the Department of Agriculture, a huge bureaucracy, the Soil Conservation Service, whose chief mission was to deal with the environmental problems, the erosion problems caused by the agricultural industry.

She didn't tell me that the pesticides and the fertilizers that we had to put on that land to maintain its productivity were polluting the surface waters, were polluting the ground waters, to the point where the Department of Agriculture now has one of the bigger ground-water quality initiatives in the Federal government.

I was never told that there was anything other than good, warm fuzzy things about agriculture when I was introduced to it in grade school.

I wonder what the public perception of minerals and the resources we take from the ground would be if Dick and Jane had gone to the mines? What if it was presented to the kids in elementary school in those formative years that there are resources, there are industrial minerals, there are metals, there are energy resources, that are the backbone of this country. That mining is an honorable profession, that it is something that we have to do, and that the image left with the kids as they leave the early grades and move up in the school is this warm, fuzzy picture of mines and machines, and minerals coming out of the ground and minerals being processed.

If we look at mining, on the other hand, just the opposite is true. Unfortunately, today, if kids are introduced to minerals at all, they aren't really introduced to them as we know them. What they're often introduced to is mining in the context of some environmental horror story. It's in the context of a list of those things that we have to stop doing, because we're ravaging the land, we're digging these holes, or we're creating polluted streams, or we're destroying ecosystems. Never even mentioning why it is those holes are there, what it is that is coming out of the ground, what role the material that's coming out of the ground plays in society. Not even mentioning that. So, if mining is taught, or if mentioned, or resource extraction is taught or mentioned at that same level that Dick and Jane were going to the farm, it's generally by a well-intentioned teacher who has to teach science and who

teaches environmental things because that is what he or she is most familiar with. When mining or resources come into the picture, it's on that list of environmental concerns that we have, things that we need to stop or we need to do somewhere else.

So the unfortunate picture, then, of that part of the resource picture of this country is not the good side, not the productive side, not the essential side of it, but the negative side. And so most kids, if they come out of school in the early years at all having heard about resources or having heard about mining or industrial minerals, they have heard only the side that we were never told when we learned about agriculture, at least in my years. They've heard about the negative side.

Well, obviously, mining, like agriculture, does have environmental problems. We do have concerns. You're spending a fair amount of time at this conference addressing those in an open forum and discussing the issues that surround the development of the minerals that we all know we have to have. But the sad fact is that our schools, elementary and secondary schools, our colleges, our Federal and State agencies, and the industry itself are not doing a very good job educating kids and adults, alike, about the role that resources play, the role that minerals play. And we are paying the price for it today.

I've spent a lot of time, more than I ever thought I would since I went to AGI, involved in education, education programs, and trying to get smarter than I was about education and how it takes place. And I have learned that it's in those Dick and Jane years, those fuzzy, warm years, that kids have their impressions made. That's where they get turned on or turned off to science. That's where their paths, their directions, their feelings about things are developed. And if they come out of those first few years in elementary school with a negative image of something or with a positive image of something, it sticks with them. Not that it's never moderated or modified as they go through school, but it sticks. And it's amazing the percentage of career decisions that are actually made back in those early years because of the impressions that are made then.

It's a fact that the science part of the elementary curriculum, where kids would first hear about minerals, rocks, geology, or resources, is being taught by a million and a half elementary teachers who teach science 20 minutes a day on the average. In many schools, it's not taught at all. Those teachers who are responsible for teaching the young kids science in elementary schools may have had little or no science in their college education. If they had any, the chances are it was biology. And most likely it was a survey course. The chances that they had any geology or earth science, at least most of the generation that is teaching in the elementary grades today, are pretty slim. In fact 67 percent or so of the teachers who are teaching today are ill-prepared, because of little or no science background, to teach any kind of science at all at the elementary level.

So when these teachers, realizing they have to teach science, reach for something they're comfortable with, something that's relevant, something that's on the TV, something that's in the newspapers that the kids will relate to, they reach for the environmental story. Not that that's totally inappropriate, but they have no background, no experience, nothing to draw on that tells them that perhaps there is another side. There is a resource side, particularly when they're talking about mining, that is just as important to convey and it really ought to be the first thing to convey.

This situation is unfortunate. In our dealing with science teachers at AGI and with the Presidential Award winners honored each year by the President for excellence in teaching elementary math and science, we are exposed to the opportunity to have an impact. When we interact with these elementary teachers, they look at our name tags that say "American Geological Institute," and say, "Oh, a geologist, boy we need more of that stuff, those kids are really excited by rocks. They are interested in everything that has anything to do with the Earth. They want fossils. They like going out and digging around streams and hunting for fossils and identifying minerals. They have more natural curiosity about the world they live in, the Earth, and the processes, and the things that come out of it, than anything else." They say, "We need more of that stuff." These are the teachers handling the Dick and Jane years. So, here's a bunch of kids with a natural curiosity, a natural fascination with the world about them who probably would be really excited by a mine, would really be excited by the fact that the limestone they're digging out there or the clay minerals, or whatever it is, is going into something that their classroom is constructed of, that they deal with in everyday life. They're not getting it. It's not in their curriculum. The teachers aren't presenting it.

So, at that time, when positive images could be presented about our mineral resources, when the setting is right for presenting this as well as the problems that go along with the use of our resources, whether they are living or nonliving, they're not getting it.

How do you teach the kids? How do you get that image across? How do you get that information across? Again, I'm not talking about a whitewash image. I'm not talking about warm, fuzzy, naive "Dick and Jane" necessarily. I'm talking about the reality that we need those resources, about setting the stage properly. How do we teach the kids that?

I think the most important question is, how do we teach the teachers? Because that's where it has to be done. It's the teachers who have to go into the classroom, and not only understand, but be comfortable teaching it.

And the time is right to do something about it. That's what is exciting and stimulating about these times and the atmosphere of tremendous concern across the country about the quality of science education. And frankly, it's because of our competitiveness. We don't like to see the fact that we rate down near Portugal somewhere, in the quality of the test results that our kids show in science and math. All of this

concern over science education motivated the President, motivated the Congress to build large science reform movements, to do as we usually do to solve problems: throw money at it. As a result the National Science Foundation, the U.S. Department of Education, and the Department of Energy and other Federal agencies have lots of money to put into science teaching reform, into science education reform. There is an atmosphere where change is called for and funds are available. The improvement must start at the elementary level. The American Association for the Advancement of Science, the largest professional organization of scientists, has Project 2061 aimed at improving the scientific literacy of all Americans. They have revisited the science curricula, come up with some guidelines for what ought to be taught. The National Science Teachers Association has their Scope Sequence and Coordination program for the teaching of science in the middle schools and high schools. And there is a tremendous appetite for science standards to be sure we are bringing everybody up to some reasonable level of science comprehension.

There's a lot of activity. And most of it to be successful is aimed in two directions: at the teachers and at what is being taught. I really think we have to go back to doing everything we can as a community that's concerned about minerals, concerned about resources, and make sure that the teachers come out of their pre-service training, their college years, having had some exposure to the earth sciences. If the earth sciences motivate kids, if the earth sciences can turn kids on to science, if not make scientists out of all the kids, at least let them understand that science can be interesting, that it can be relevant, then we should take advantage of it. Earthquakes and landslides on the negative side, and mineral resources on the positive side, are important parts of their lives. If they can understand this at a very early age, then they are going to leave the elementary years thinking that science is interesting, science is relevant. It's useful. But the teachers have to be able to tell them that. They have to both take that natural curiosity outdoors and bring earth science into the classroom.

We have to reform pre-service training in the sciences to equip our teachers, especially at the elementary level. We've got to work through the universities and the State education departments where the action is, to make sure that science teachers teaching elementary education have science, that they have some earth science, and that resources are an important part of that earth science curriculum. Not all earth science courses taught in colleges do resources justice, so we must work to encourage faculty members to include resources in their courses.

We also have to work in in-service training, the training the teachers get after they're out of college and in the classroom. Realizing that most of the elementary teachers are deficient in sciences, there's a lot of money being put forward to try to retread, to retrain them after school, during school, and in summer programs. If we don't do something

about the pre-service, we're going to be doing in-service or remedial training forever. It needs to be a two-pronged effort.

This is one place that earth scientists with an interest in resources can play an important role. If we can develop the incentives for teachers to get into in-service programs, if we can create teacher workshops and institutes like those we had in the sixties and seventies, and if we can make resources an important part of that program, we can ensure that the earth science the teachers get does include a resource perspective.

We can also create materials for teachers to use in the classroom. This is where we probably have done more and had less effect than we think we have. AGI had an education conference back in February, and we invited the Federal agencies who were turning out materials for the schools. Representatives from NOAA, NASA, EPA, USGS, and others in the Federal geoscience spectrum brought the materials they're turning out. We had lots of teachers there, too. And we found out many teachers feel that a lot of this very well intentioned classroom material, designed by people in government agencies, in the industry, in the oil business, or in the minerals business, never gets used. Why? Because the teachers don't understand it. They don't know how to use it. It's too much. It's too technical. It's too detailed. It's too long. They have 20 minutes a day for science and it doesn't fit the curriculum. It's flashy, and it's pretty, and it's detailed, and it makes the geologists sit back and say, "Boy, this is fantastic stuff." But to that overworked elementary teacher who has to teach math, science, English, geography, music, social studies, and other subjects, to be thrown these wonderful stacks of materials that are way over his or her head, and whose science background may be one college biology course, the material won't do what we all had hoped it would. Materials are important, but materials alone don't fill the gap, especially if they are targeted too high. We have to be very careful about what we put in their hands. It has to be something they're comfortable with.

We also can get involved with the curriculum. The science reform movement that is going on today in the U.S. still has an open door. The AAAS program, the NSTA program, are still building model curricula. They're going out into the school districts around the country and they are getting teachers involved. Whenever materials and curricula are designed, you need that reality check of having teachers to say, "That won't work," or "That's great," or "You've got to do it this way," or "Don't do that, that's stupid." Let them help write, let them participate in all of these things. As we in government, industry, and universities get involved in the business of shaping curricula and working with science reform movements, we must be sure we have the teacher perspective.

Work through your professional associations, or through AGI; all the professional associations have their finger in the science education pot today. Those of us that have mineral interests, energy resource interests, and

associated environmental interests ought to be pressing on our professional societies to be sure that this great science reform movement that's sweeping the country doesn't pass us by, that we have our chance to get a balanced perspective on resources into the curriculum and into the schools.

Finally, in terms of how we help, how we work with teachers, there's the opportunity for the involvement of professional earth scientists in the classrooms themselves. There is nothing more humbling than to go in front of a class of 6- or 7- or 8-year-old kids and try to communicate with them. You really get an appreciation for attention spans, and what does and doesn't interest kids. There are many partnering programs out there now, professionals in the classroom programs, being sponsored either by school districts or by professional associations that give geoscientists, engineers, chemists, and biologists a chance to go into the classroom and work with the teacher. Most of these programs have realized that the professional has to be trained before he or she does it, because you can go in there and lay the largest egg in the world if you shoot too high, and don't play to their interests. But the kids really get excited if they get somebody in there that's good, and it is a very pleasant feeling to have kids respond and get involved.

If what you present fits the curriculum, if it fits the teacher's lesson plan, it takes the pressure off them. They have their 20 minutes filled that day. They don't have to worry about it, and you can have a tremendous influence and make an important contribution if you do it and do it well. People from industry and people from universities need to take the opportunity to work with the teachers and get in the classroom to bring the mineral story to the students. We as professionals recognize the role that minerals play in our society, and we admit there are environmental and land-use problems associated with resource development. We are responsible for getting a balanced view of these realities into the minds of the people of this country, and the minds of the school kids is where it has to start.

It's true that the idyllic picture of agriculture portrayed in "Dick and Jane" never really existed. Today we can't teach that simplistically. Our professional ethics demand and our consciences demand that we teach people about the way things really are. We should teach them about the importance of resources, and we must include the negative things, the tradeoffs that have to be made, and the risks that we have to take to live in the modern world today. What we really also have to do is face the fact that the basic understanding, the fundamental importance, of the very resources this meeting is about, is not recognized by the teachers who teach, thus by the kids who are taught, and therefore by those kids as they become mature adults and voting adults. As a result we are missing an opportunity to inform right now, with the science reform that's underway, with the tremendous attention that's being paid to science, to have another shot at it. We have to do everything we can to work on education programs through teachers, the universities, principals, and Parent Teachers

Associations to get resources, both energy and mineral resources, the place they deserve beside Farmer Jones and agriculture. If we work with the teachers and work with the school systems to build those understandings, to get them across to the daughters and sons of Dick and Jane, we might get them on their way to the mines. We might even get them there before they get to the farm.

PANEL SESSIONS—DAY 2

Tuesday morning, September 17, 1991

Timothy S. Hayes:

Welcome to day 2 of our Workshop. Our discussion continues with the panel on mineral production in an environmentally responsible manner. The panel leader is John Kiefer, Assistant State Geologist for the State of Kentucky.

MINERAL PRODUCTION IN AN ENVIRONMENTALLY RESPONSIBLE MANNER

Panel leader:

John D. Kiefer, Assistant State Geologist, Kentucky Geological Survey, Lexington, Kentucky.

Panel members:

Carl Blomgren, Senior Environmental Engineer, U.S. Environmental Protection Agency, Kansas City, Kansas.

Virgil W. Smith, Jr., Vice-Chairman, Oklahoma Mining Commission, Oklahoma City, Oklahoma.

Kenneth V. Luza, Oklahoma Geological Survey, Norman, Oklahoma.

Micheal J. Thompson, Enforcement Administrator, Arkansas Department of Pollution Control and Ecology, Little Rock, Arkansas.

PANEL PRESENTATIONS

John D. Kiefer:

Dr. Charles Mankin asked me just a minute ago what I'm going to cover that hasn't already been covered. Actually, at least some of what I'm going to cover has already been discussed in a somewhat different context, but I think some of these points need to be reemphasized.

I was on the planning group for this meeting, and perhaps the story I'm going to tell had a lot to do with getting the initial planning for this Workshop started. Our goal was to develop a forum or Workshop which would deal with the more practical or applied issues in mining and quarrying, operations that currently are impacting our expanding urban areas.

Mineral production in an environmentally responsible manner—what does that really mean? What does it mean to be environmentally responsible? Let's take a look at what it might mean and then get into some discussion with our panel.

Yesterday, Tim Haithcoat made the point, and I think it was a good one, that what we're dealing with are perceptions, perceptions coming from a lot of different perspectives. First, we might have the governmental, regulatory agency, perspective. They develop regulations which they hope will protect the environment for the future. These often may appear to be very stringent, especially from industry's point of view. But, in fact, this may not really be true. Regulations, as we know, must work with the least common denominator, and at times must generalize in order to cover all situations for a broad area. Regulatory agencies are also plagued by the common problems of inadequate funding, which in turn leads to chronic understaffing and a lack of the trained, qualified personnel who would enable them to properly enforce the regulations. Therefore, although the intentions may be admirable, regulatory agencies frequently do not achieve the desired results. Often perceptions are tempered by basic reality, and the end results are not what those drafting the regulations might have anticipated or hoped for.

What about industry? Well, industry's perception always has to be tempered by the infamous bottom line, despite the fact that industry will frequently claim that, "We have to live here also so we are just as concerned about the environment as anybody else." The end result more typically is that to industry, "environmentally responsible" means adhering to the letter of the law, doing what's necessary to obtain the permit, to obtain the approval of the regulatory agency. For lack of a better term, it may also mean cutting some corners, if the opportunity presents itself. Not because they want to wantonly despoil the environment or cause problems, but, because we're not talking about a high-profit margin commodity, you have to keep that bottom line in mind or you're not going to stay in business. So, you do what you have to do to remain viable.

And then there's the public. What's their perception? It depends to a large extent on "whose ox is being gored," or to put it another way, your proximity to the extraction site. It also depends to a great extent on the educational level of the persons you're dealing with and their environmental mind set. As Dr. Chip Groat indicated last night, somehow the very idea of mining, or to use the term "exploitation," of natural resources sounds like something that is inherently environmentally irresponsible. You're going to tear up the Earth and take something out. Add to this the fact that the "not in my backyard" syndrome, the "NIMBY" syndrome, is becoming nearly as prevalent in regard to siting quarries and mines as it is to siting landfills, and you have a major problem. It's becoming very difficult to site a new quarry. You then have a potentially volatile situation and a great need for communication and education. The public perception is one of dust, noise, blasting, heavy traffic, and a big

hole in the ground that you can't do much with after the operators leave. In short, it's something that the public understands little about, but which they know is certainly going to disturb their environment. You also have the perception of such people as planners, but that's highly variable and generally follows the trend of the public and is influenced by the incumbent politicians who are going to follow the perceptions that will give them the most votes. This may or may not be the correct choice. It follows the logic of a public that indicates in polls that it is willing to pay the cost of a better environment, but then votes the politicians out of office when they raise taxes to do so.

Our question then is how do we reconcile these different perceptions? Can we? In fact, do we even need to? In my opinion, the answer is "yes," and the reconciliation has to be via public relations and education, but I'll get back to that in a moment.

I want to look at an example of the type of problem that brought us here and what can happen if you don't focus on environmentally responsible mining. A company, which I would like to consider a normally very responsible company, applied for a zoning variance to expand their operation, which is a combined surface and underground operation. They had already had some minor problems with dust, blasting noise, spoil washing into streams, and siltation. These were minor problems but led to poor public relations and could have been avoided, for the most part, by careful planning. To expand in their planned manner necessitated mining beneath a small but unique and environmentally sensitive stream. The quarry is in a relatively rural area, and the stream flows in a series of falls and rapids, including some unique travertine falls deposits, through a highly faulted and fractured area into a major river. The stream and its tributaries flow along and through a nature preserve owned by an elderly lady, a former college biology teacher, who has willed the preserve to the county, including money to support the preserve after her death. Maps showing the extent of the underground operation were not available. Mined-area maps are not required in Kentucky so the extent of the mined area was not known. At the hearing we were assured that the mine was dry, the rock was sound, showed few fractures, and was impermeable. In fact, the operators even brought around 2½ ft sections of core that were taken in the mine, and said, "Look at this sound rock. Totally impermeable. No fractures in it." As any of you know, you usually can pull a piece of core from somewhere and it looks like a nice, sound piece of rock, but that's not what the water flows through. That's not where the problems are. Most of the water flows through the fractures *between* the solid sections of rock. The review board was told that mining beneath this stream could be accomplished successfully with no environmental impact. Of course, there were doubts. Mining beneath the stream can be done, but it's a fairly expensive process and must be done carefully. However, there was an attempt to bring in some big

name consultants and bulldoze the issue past the zoning board. It didn't work. The opposition hired a consultant who had noticed on aerial photographs a change in the vegetation pattern. His presentation was not particularly convincing, but it was just enough to sow the seed of doubt so that a judge ordered an independent survey of the mine. That survey showed that the company had not only already mined under the stream but actually had mined limestone from beneath the nature preserve. The stream was already showing signs of stress and reduced flow. The inspection also showed that the mine was not dry, and a considerable amount of water was standing in some places in the mine. Of course, a major lawsuit followed. Add this to the fact that the company had also been cited for dumping stone in the creek, although they maintained that the stone had washed in during rainfall. They were risking disaster which could have been avoided by some careful initial planning.

Where does it leave you when you ultimately get in that situation? What impact does this have on expanding not only that quarry, but any quarries in the vicinity? And, for that matter, siting new quarries in the State? How does the public, then, and any other zoning board, view the quarry industry? Obviously, it does a great deal of damage to the industry's credibility. It's going to cause problems for a long time to come. In fact, the urban county government formed a committee to develop a quarry ordinance, as Bob Joice discussed yesterday.

I believe the ultimate answer lies in being "up front," as Mr. von Achen mentioned yesterday. You've got to present the facts and deal with them in an honest manner. You've got to educate the public to what you're doing. As Chip Groat said last night, I've gone into a lot of classrooms and asked the students what they know about limestone. Where do cement and concrete come from? Usually what you get is a lot of blank stares. The public knows little about the source of this important commodity. What do they know about quarrying? Again you don't get much of an answer. So I think what some of you are doing is the right approach, conducting educational trips to the quarry, passing out educational information, putting together audio-visual information about quarrying and mining. That's what we have to do. We must not hide from the public, we have to be up front about it.

Now I call on the members of our panel to give us a little insight into the problems in their areas, and what they would consider environmentally responsible mining.

Carl Blomgren:

My career extends for about 40 years through EPA and its predecessors, and with the State of Iowa. This is my first opportunity to speak to a specialty group of this type and I appreciate it.

In the Midcontinent region, we in EPA Region 7 carry out the programs of EPA in Kansas, Missouri, Nebraska, and Iowa. I believe a representative of the State of Missouri will

discuss the Missouri requirements on mineral production on a panel that follows, and therefore I feel a responsibility to talk only about what the Federal impact is on the extraction and handling of industrial minerals.

But before I say anything which might be judged to be critical of industrial minerals extraction, I would like to tell you that as a product of the Depression I lived in the county seat town in Monroe County, Iowa, and we kids thought the old “Cottonwood Pits,” where the railroads extracted the clay and fired it for use as ballast, were just about the greatest place going. We didn’t have any of the modern-day swimming pools or the fun things that kids enjoy today. Well, so much for clay extraction—it left a great residual benefit for poor kids.

First I’d like to discuss EPA’s requirements that you might encounter in the planning stage of a mine or quarry operation of this type. Some of this is particularly true in parts of the Missouri River where there is extraction of sand around Kansas City; those activities require a permit from the Corps of Engineers under the Rivers and Harbors Act, Section 10. The Corps consults with us and we coordinate in making comments about those permits, but the direct responsibility is with the Corps.

Another aspect of initiating a project on or near the waters of the United States would be application for a Section 404 permit under the Clean Water Act. This requirement originated with Public Law 92-500 in 1972. It places initial and primary responsibility on the Corps of Engineers with a supportive and review role by EPA. These regulations are commonly called the dredge and fill regulations.

The National Pollutant Discharge Elimination System Permit, commonly referred to as NPDES, is required where an excavation involves dewatering operations. This section of statute also was a result of the passage of 92-500 in 1972. There has been a recent amendment to the Clean Water Act which requires EPA and the States to look into controlling storm water runoff. In this regard there will be a period for a lot of sampling to determine just what is taking place and if there is any degradation in water quality before any regulatory impacts will be felt.

Iowa has sought and, I believe, has received authority from the State Legislature to issue general permits, which won’t require permits for each individual operation, but will apply to all of an operator’s facilities of that type in the State. I would also add that it is rare in the administration of these permits and compliance activities that EPA oversees or takes enforcement actions where a State has failed to do so.

There are some added requirements when spoil or fines from sand and gravel operations or when limestone or other aggregate materials are accumulated or stored, and there is a possibility for either fugitive dust or dust emanating from rock crushers. There is a separate document which outlines requirements covered by either the State of Missouri or EPA in the case of fugitive dust from these operations, and by the new source performance standards which must be

complied with after August of 1993 for the installation of crushing machinery.

Yesterday, we heard an endorsement of geographic information systems technique (the GIS). The EPA is responsible for collecting a lot of geologic data. There is a lot of drilling at sites where the owner of the facility is required to take corrective action under the Resource Conservation Recovery Act, or where the potentially responsible parties are drilling to determine the extent of contamination at a Superfund site. I would certainly endorse putting these data in a format and system that can be used by others, because now data come to us in paper form, become a part of the file on that site, and probably are not usable to others.

This is a rather brief explanation of the Federal environmental role in the extraction and handling of industrial minerals, but my research has shown that these are the only requirements that apply to these kinds of operations.

Virgil W. Smith, Jr.:

I’d like to establish that besides being a member of the Mining Commission, I’m a retired general manager of the Dolese Brothers operations in Oklahoma, where I’ve been involved in quarry operations for 37 years.

There is obviously a unanimity of opinion on the things that we need to do. I have something that I present here as a confession and a sermon. I hope that (at my 69 years I’m older than most of the people in the room) most of you don’t have to get as old as I am to learn that *you set an example*. You are setting an example every day of your life. You don’t have a choice. You set the example whether you want to or not. That’s a pretty heavy burden to lay on yourself if you accept it.

The notes that I made before I came say that management should be leadership. Leadership in business as well as in the family is the *setting of examples*. Business is a vital part of the local community, therefore an important member of the community family. All of management’s actions are examples seen by the employees and the members of this community. Reluctant participation in environmental issues is an unacceptable example, an obvious message to the community that environmental issues are not seen as important by industry. It is imperative that industry take the initiative in all areas of community relationships. Why wait to be forced to comply with regulations and be perceived as a poor neighbor? An industry that leads the community in the area of environmental issues can expect to reap the benefits received by the image presented by this positive example.

I want to emphasize that all particulate matters aren’t the same. During my career I have worked in fairly high-purity limestone quarries, and I have never known a single person to have any physical problems with limestone dust. The benefits of the limestone dust that emanate from a quarry are very, very measurable. The farmer that has a field next door gets free ag-lime; it works, and I’ve seen it work

for years and years and years. Twenty-five to thirty years ago, as I drove I'd see the dust billowing from a quarry, and I could see it 3 or 4 miles before I got there. I was happy. But now if you see it half a mile away you're unhappy. There's been that much change, because of the environmental control. But in defense of good clean limestone dust, it does help. It also helps the air quality, because the limestone dust kills the sulfides in the air. So it's not all bad. [Editors' Note: The reference is to the dust neutralizing the acidity of water vapor, the acidity results from oxidation of sulfides to form sulfuric acid.]

I'm also concerned about environmental issue agencies that measure particulate matter but don't determine what the particulate matter is. One farmer makes more dust in a day than any quarry in the whole State of Oklahoma. And that's all particulate matter.

Another issue someone talked about is education. The National Stone Association does have an excellent VCR presentation on blasting. It is available to you, if you contact them, and it's a good community relationship item.

Another point is that there should be equitable inspection by environmental agencies. As a manager of a leading producer in the State of Oklahoma, I can assure you that we received more inspections and had more requirements imposed upon us than anybody else in the State. We were required to comply with regulations, whereas small producers were never inspected. This to me is unacceptable, but it happens, and it happens continually.

There was an allusion to recycling, yesterday. I have been personally involved, hands-on, with the installation and operation of five different recycling set-ups. I am a strong supporter of recycling. In Oklahoma City practically every ton of stone that comes into town has to be hauled 70 miles. So, the economics of recycling are very, very positive.

Among the points to consider, if you recycle, you have fewer trucks on the highway. If you have fewer trucks, you're putting less rubber on the road, less burning it up, and you'll have lower diesel fuel costs. You won't have to mine as much iron ore in Minnesota to make steel to make fewer trucks to haul rock and fewer ships to haul oil all the way from Saudi Arabia, to run the diesel in that truck that goes up and down the road. Recycling is really a worldwide environmental issue. Another point—I ran into serious conflict with the general sales manager, who wanted to work with a nice clean, virgin, specification stone. But if you take machinery and set up a three-stage cleanup in a recycling plant, you can make three different products. One of them you may have to throw away or use for fill, one of them can be miscellaneous crusher run (suitable for road rock driveways), the third one can even be State specification—traffic-bound surface coarse rock. All that can be achieved in a recycling plant. We had one case where we even paid the contractors a dollar a ton to bring their broken-up concrete and dump it next to our plant, and then we could crush it for a dollar a ton. And we could sell it for \$4 a ton. The haul rate from a quarry to

Oklahoma City is in the range of \$6.50 to \$7.00 per ton. We're talking about a product that at the quarry is only worth \$2 a ton. That's a workable cost-to-sales price ratio.

So, I'm a strong supporter of recycling. Dust control in a recycle plant is very easy, because all you're going to do is use water. All base materials require moisture and so you have a compatibility of your dust control with the design specifications of the end product.

John D. Kiefer:

Thank you, Virgil. You made some key points, especially in the area of recycling. As Virgil pointed out, it's no longer our decision. Recycling is here. It is not just a national but an international problem. I would also call attention to Mr. Smith's point about industry being the leaders. Instead of sitting back and letting things happen and then getting caught in a trap where you don't have much of a choice to direct the functions of your industry, you need to play a leadership role and make sure the public understands what constraints you are working under, and just how important that product really is to the consumer. You've got to keep hammering at that point to educate them.

Kenneth V. Luza:

Our organization, like many of the other State Surveys, is primarily a research and public service organization. The Oklahoma Geological Survey serves as a resource to the mining industry and to various State agencies that regulate and issue permits to the mining industry. Unfortunately, regional and local planners do not utilize our organization for information. Valuable geologic information, such as the thickness, distribution, and occurrence of sand and gravel resources, is not being incorporated into any regional and (or) local plans in Central Oklahoma.

The sand and gravel and stone producers play a major role in the present and future development of a community. Small as well as large operators spend very little effort to inform and educate the public. This lack of effort is, in part, responsible for the public's very negative perception of the mining industry.

Mine operators need to get more involved in education and the development of better community relations. For example, mine/plant tours can be offered for youth groups, school groups, service organizations, and visitors on selected days. For example, I took a group of Boy Scouts to a sand and gravel operation. Now, what can you say about a dredge sand and gravel operation? You don't have a big hole in the ground to look at. You have a lake, and piles of sand that have been sized. We had an excellent tour. We went on a Saturday when the plant wasn't running, which gave us an opportunity to have a close-up view of the processing equipment. In this part of the State, the gravel is set aside; sometimes it is used as a decorative rock in flower beds. The

gentleman who was giving us the tour said, “Well, kids, you’ll find some fossils in this gravel pile, fossil bones,” and we weren’t there more than 5 minutes when one of the boys found a bison tooth. So we spent another hour on this rock pile looking for additional fossils. When the boys went back home they told everybody what a fantastic time they had. This positive experience gave the young boys and adult leaders a different perspective on the mining industry.

I think it’s a very important part of the need for education (a common thread through this entire meeting) for the operators to get more involved in a community in the educational process. The school teachers will be tickled to death to know that you have an operation and you welcome visitors and students. You can make it very interesting and tell them where this material goes. Most of them don’t know. Displays and (or) visual aids can be used to explain how the commodity is extracted, processed, and used in the community. Furthermore, the various regulations that govern mine development and land restoration as mining proceeds can be explained.

John D. Kiefer:

Again, Ken has emphasized the educational aspect. Just having a small shelter at your quarry where teachers can bring the school children can be a positive step. Perhaps have a few pictures of your operation, something to show what your product is, what it is used for, and so on. You will be amazed what that can do for public relations. Also, the aspect of mine planning, one of the things I didn’t mention, can be so important. I have worked with several companies where they worked with the community on the initial mine plan to develop something for the future. When the company left, the community was going to have something—a lake, with a park surrounding it, for example. If you can work something like that into the plan, even if it’s 30 or 40 years down the road, it’s a tremendous benefit and public relations plus.

Micheal J. Thompson:

I’ve only been involved with the environmental regulation of the mining industry in Arkansas for about 3½ years, though I have been involved in environmental regulations for more than 16 years. Environmental regulation in the mining industry in Arkansas has been active since 1971. Regulation was not received well by the mining community at first, but it is now accepted as part of doing business. Though none of the operators has indicated that implementing environmental preservation practices saves them money, many have indicated that their image as a good neighbor has improved, and in some cases good reclamation of affected land has actually made it possible to obtain mineral leases they might not otherwise have been able to obtain.

The Mission Statement of the Arkansas Department of Pollution Control and Ecology is, “To protect and enhance the environment by the control and abatement of pollution

that might adversely affect water, air, and land, in a manner consistent with the economic welfare and well-being of all Arkansans.” The citizens of the State of Arkansas are very protective of their stream quality, their air quality, and the pristine natural setting of the land. They do not want to see mining stopped in Arkansas, but they do want it carried out in a manner that will protect the public health and environment.

Over the past few years, public awareness and concern over the environmental soundness of mining operations and their seemingly inherent threat to the public health and well-being have grown significantly in Arkansas. The concerns expressed range from the suspended solids that can get into nearby waterways from leaking or overflowing ponds or surface water runoff, to concern over the contents of water that has come into contact with spoil material, ore, and (or) process waste. These concerns involve both active and inactive mine sites.

The concerns expressed by the citizens of Arkansas are not unlike those being expressed in other States. This is evident from the recent actions being taken by the Environmental Protection Agency to bring the control of mine process waste under the Resource Conservation Recovery Act (RCRA) and the control of storm water under the National Pollutant Discharge Elimination System (NPDES).

The technology and methodology for controlling mine process waste are going to be unique in each State due to the variations in geology from State to State. For this reason, many States have sought to have input in the law-making process that will result from EPA’s efforts to control mine waste under RCRA. Through initial efforts made by the Western Governors’ Association (WGA), the EPA provided some funding to the WGA to incorporate its considerable expertise in non-coal mine problem abatement into the rule-making process. EPA recognized from the input of the WGA that all States to be affected by mine waste regulations should be involved. The Interstate Mining Compact Commission which represents a significant number of the eastern States, including Arkansas, and whose purpose is “achieving and maintaining an efficient and productive mining industry and increasing economic and other benefits attributable to mining,” worked with EPA to arrange funding for participation in the rule-making process by the remaining interested States in which mining takes place. Through this ongoing cooperative effort, the States have been able to apprise the EPA of the uniqueness of the problems each State has and the importance of State participation in the development of the rules that are promulgated.

Another issue that rose out of this cooperative effort, that was consistent with the concerns in Arkansas, was what to do about abandoned or inactive non-coal mines. Every participating State has abandoned or inactive mines that are creating, or have the potential to create, environmental hazards and pose a threat to human health and safety. This is an issue that will no doubt be addressed in the future.

As indicated in the Mission Statement, the Arkansas Department of Pollution Control and Ecology is aware of the need for economic well-being of all Arkansans. It is the desire of our Department to be able to work with each owner/operator from the very beginning of his mine operation to assist him in the development of the mine plan and reclamation plan, in hopes that we can assist him in setting up his mining operation to comply with the environmental laws in the most economic fashion available to him.

I would also like to comment on a couple of other things that have already been mentioned. Planning ahead is so very important. We would like all our mine operators to come and visit us, from the time they decide they want to mine in a particular area, and let us work with them so that we can advise them of the kinds of things that they may have to address to protect the environment in the area where they want to mine.

Also, image is very important. A lot of folks simply don't even know how mining touches their daily lives. They don't think about the fact that the brick on their home came from a clay mine, or that the sheetrock in their home was mined. I just don't think a lot of people recognize the importance of mining as they do for farming. People know that when they eat food it came from a farm, but they don't realize that a lot of the daily products they deal with, other than farming, may have come from a mining operation.

I think education is necessary. If the mine operators can educate both the people in Arkansas and the rest of the country on how important mining is and how much it touches their daily lives, I think they'd be a lot more receptive to different proposals and actions of the mining operators.

John D. Kiefer:

Thanks, Mike. This pretty well sums up our presentation. To pull it all together, you need to have good PR, you need an educational component, and the whole process must be cooperative with the public, the public officials, and with the regulatory agencies. I cannot emphasize the latter enough. I know that in many cases you consider the regulations a nuisance. However, if you fight them, it's going to make it even more difficult. I can use the situation in Kentucky as an analogy.

The oil and gas industry did not want the State to have primacy in the matter of underground injection controls. The industry fought the issue, and the State did not get primacy. As a consequence, the EPA took it over. Now the industry's problems have increased. Now it takes 6 months to a year to get a permit, and even then, if it's kicked back, it may take them 2 years to obtain. Instead of working with local people who have the interest of the State at heart, the industry is working with people who may have little real knowledge of their operation or the local geology. It is much better to cooperate and try to work within the regulations. Maybe you

can make some changes for the better. But if you fight them, it may result in a problem for all of us.

DISCUSSION

C. Dudley Blancke:

Mike mentioned the uniqueness in each State. I think you should carry that further—the uniqueness of each mine. The regulations should take into consideration that the location, the material you are mining, and its occurrence make land reclamation conditions entirely different for each operation.

James F. Murray, Martin Marietta, Savannah, Missouri:

I would like to present a couple of points from an operator's standpoint. One of the biggest problems that we have with regulatory agencies is the inadequacy or the educational level of the inspectors that come out to tell us what we have to do, to help us put together our mining plans. Specifically here in the State of Missouri. A lot of operators have problems with the air quality section, in that when you apply for a new air permit or a construction air permit, the inspectors come out and do a survey and try to help you put together the restrictions on your permit. Unfortunately, a lot of times, you get people out of the agencies that have never been in a rock quarry before, have never seen dust coming from a plant, and have never seen trucks moving rock in the stockpile area, kicking up dust. You have these kinds of inexperienced people regulating our industry, which makes it very, very tough.

Fortunately, there are commissions, like the one Virgil Smith sits on, and here in the State of Missouri the Air Quality Commission and the Land Reclamation Commission, where we as producers can go if we don't like or agree with something that the inspector has done. That's another step that helps us, but here, again, that takes away time and effort from our responsibility to, number one, make a profit, and that's the only reason that any operator in this room is in business today. We also realize responsibility to the environment, to our neighbors. I don't think there's an operator in this room that would not like to consider himself a good-quality corporate citizen who tries to comply with all the regulations that are set forth, but we have to do it in such a fashion and cooperative manner that, number one, we make a profit.

There also was one point that Virgil Smith made, relative to differential treatment by these regulatory bodies with regards to writing citations to different producers. I think Virgil made a statement that the company he worked for was one of the largest producers in the State of Oklahoma, and I am sure that the air quality people and MSHA (Mine Safety and Health Administration), all those people just love to

come on to his property. They knew that company was probably trying to do the absolute best that they could to comply with some of the restrictions and requirements of the law. I'm sure these inspectors would go to another quarry site that maybe wasn't quite as big as what Virgil had, and a lot of times they would overlook a lot of things that are in the regulatory book. Large producers have a real tough time with that. Martin Marietta is a very large producer, and we feel that we are singled out and get selective treatment by a lot of these government agencies. I don't know what you can do about it, you live with it. We've come to the point where we think MSHA and a lot of other folks have a tendency to nitpick so they can perpetuate their jobs, which makes it pretty tough.

John D. Kiefer:

You made several key points. The issue with the regulatory agencies and poorly trained personnel is a major problem. It is something you're not going to change. It's there and you have to learn to deal with it. It is a problem in Kentucky. They cannot pay well, and therefore when people learn their jobs, good workers move on and go with a consulting firm or a mining company. The same is true with every State—the situation is there and it's not going to go away.

Another problem that I have noticed, when I have accompanied surface mining reclamation inspectors, is the variation among the different inspectors and the way they perceive the mining operations. There is a lot of variation in degree of enforcement within the State, among the different inspectors.

John A. Taylor, Secretary, Oklahoma Mining Commission, Oklahoma City, Oklahoma:

The last couple of days I keep hearing about public awareness, public relations, the public should know, the public needs to know, land use, pollution. You know, increasing troubles relating to environmental problems and the public and what are we going to do about it and what are we doing about it. Different States doing different things, and it's all a matter of communicating with the public. I'm sure we all agree, and we've had some good suggestions here. I can't help but point out that there's an increasing history of this in some organizations.

At the Oklahoma Department of Mines a little over a year ago, we made a small but good start, to enhance public awareness. We created a position for a public relations person on the staff, who designed and caused to be designed a set of panels, and redid the literature we've always had in the Department of Mines. We borrowed information from several States and got a chance to see how the other States are doing. It's quite interesting to see that some States are doing a lot and some not very much. And so we have a person

whose job it is besides designing this, to go around and make this available at gatherings, at the State capitol, at schools to school children, at the Lions Clubs, and various other places. All to foster public awareness.

It might be useful to point out another industry and how they handle it. An industry that's had quite a lot of problems the last 70 years is the oil industry. They still have problems. About 15 years ago, the American Petroleum Institute caused to be designed about 12 canned slide shows with written material and slides on different subjects on the oil industry. I can think of a parallel thing in the mining industry, so that any given subject would be covered by one of these shows or a combination thereof. Copies were made. They were sent to every State, to the National Petroleum Council State office. These were made available to the Kiwanis Clubs and the various organizations you can think of. It really permeated throughout. They were pretty simple but were descriptive. They were designed for the public, public information, public awareness. What is our industry about? What does it do? We're all amazed about how much the public does not know about us. I think they know less than we think, but it appears to me that maybe we, as a mining industry, could coalesce in some fashion and learn from some of the States that have done this more, and arrive at some commonality, and design some material that can be useful, and be made available by our various States, our various Bureaus of Mines or Mining Commissions for distribution to the public for better public awareness to start building this threshold of availability and knowledge that can help us all.

That's just an observation. I might add that I was co-chairman of the group 15 years ago that started this program in the oil industry and so have some knowledge of it. And it helped a lot and it's still available and is still working.

Bruce H. Mason, Executive Director, Indiana Mineral Aggregates Association, Indianapolis, Indiana:

I would like to make a couple of comments, my first directed toward reclamation. A number of years ago, the industry approached the legislature in Indiana and said that reclamation's time had come. We in the industry, after a lot of comment by our members, agreed that we should support a reclamation law. There was a unanimous opinion on this position. The industry approached the legislature and a law was passed. The industry was assured that the rules written to implement the law would be applicable to our business. Needless to say, the rules, as they were written, were more applicable to coal than they were to sand and gravel pits and limestone and dolomite quarries. The hue and cry that arose from the industry concerning the implementation of those rules prompted the legislature to repeal the act.

I would like to get some comment from the panel on how they would address a problem such as this. When industry takes a responsible step and says, "We think this

ought to be done,” how can you assure that the rules that need to be written will be applicable and not something “from outer space” that won’t apply to the industry? In this case the rules written would have put a lot of companies out of business. The rules didn’t recognize the discrete differences between sites, as the gentleman from Martin Marietta [Mr. Murray] so eloquently said, and the retired mining engineer [Mr. Blancke] also pointed out. Each site has to be considered on its own merits.

Secondly, I wish to address another issue, permits. Industry in Indiana has had problems with permit writers. The Indiana Department of Environmental Management (IDEM) has a revolving door with its permit writers. This is due to a lack of funding and low fees, payments for the services rendered by IDEM. There is the perception by industry that the present services rendered by IDEM aren’t worth what industry is paying in fees. I talked (representing this industry) to the IDEM people, about the problem of receiving permits in a timely fashion. I was informed by IDEM that, “Well, you really don’t have a problem.” We polled our members and found out that out of 40 members, 18 were having problems receiving permits in a timely fashion. Now, 40 members doesn’t sound like much, but that represents permits for about 130 to 140 pits or quarries. I went back to the agency and said, “There is a problem, and we think we know what the problem is. It’s a lack of understanding.”

In the aggregate business, we have our own vocabulary concerning equipment. When industry personnel were sending in their permit applications, they were listing equipment according to their vocabulary. IDEM in some cases wasn’t sure what the terms being used meant. We knew what we were talking about, but IDEM didn’t. The outcome of those meetings with IDEM was that the problem of using improper terms lessened.

The industry also lobbied through the legislature for increased funding for IDEM. We asked that the department be adequately funded. We accomplished that. IDEM now has new permit writers on staff and, on August 2nd, industry will be taking some of these new permit writers on a tour of some of the plants. We will be able to show the permit writers what a crusher, a screen, a conveyor, and transfer points look like. We will be able to demonstrate what particulate emissions are, see fugitive dust, etc. We think that the secret to solving some problems is to improve communications with the agencies.

Another thing we’ve attempted to do is work with our geological survey and State agencies to get what we call the “Adopt a School Program” going. We are trying to encourage our producers to adopt a school district and to provide the schools with visual aids and resource materials necessary so that the district may properly inform their students about the natural resource base and society’s needs for these resources. These students are going to be citizens who in the future will sit in judgment on this industry.

D. Anne Lewis:

There are common experiences among many of us in this room. Bruce Mason’s comment was that when the rules and regulations for industrial minerals were drafted, they came out having a great similarity to the coal rules and regulations. We had the identical experience in Missouri.

After our first version of rules and regulations was published in the State Register, industry, maddened by the stringency, the similarity to coal law, and the perception that they had not been adequately consulted or collaborated with, took the case to the Joint Committee on Administrative Rules and had the entire document nullified. There were industry people, present in this room, that were then invited to be part of a task force. I think that this probably happens again and again unless there is a collaborative effort of the technical staff in the land reclamation programs and the industry to work together from the onset. In defense of our situation, I would say that so much of this comes down to human chemistry. We found that once we took out our brand-new out-of-state staff director and our paid executive directors of the industry organizations and segregated their personalities and perhaps mostly the brand-new-ness of the director from Wyoming with a whole different kind of attitude than being a Missourian, and brought in a mediator with a gentle disposition, that things eased up a bit. That mediator in fact, will be on the next panel, John Young, the Deputy Director of DEQ (Division of Environmental Quality).

So, I’m intrigued to hear it said that the State of Indiana had the same problem. We’re hopefully trying to fix ours.

Virgil W. Smith, Jr.:

In the State of Oklahoma, when some regulations were to be promulgated, Dolese Brothers Company retained the services of a retired executive vice president who was an attorney, and he participated in the drawing up of the rules and regulations. When he got through with them, he handed them to me, and I proofread them. Industry needs to participate in the drawing up of the rules and regulations. You cannot let some uninformed person make the rules for the way you live. Industry must participate. And, it’s going to cost you some money, but you have to participate.

Micheal J. Thompson:

When you went to your legislature and requested reclamation regulations, did you not have a public hearing process that you could go to and have input into the regulations that were to be promulgated? You know, that’s usually your best opportunity, if you don’t have an opportunity to go and sit down with those people who are writing the regulations to begin with. Most State agencies, if they are like ours, are open to anyone who wants to come in and talk and express their concern.

Virgil W. Smith, Jr.:

But I disagree with the timing. It's too late then. You need to get in at the beginning, not at the end.

Kenneth V. Luza:

The process doesn't stop after everyone is happy and they agree with what the committee has decided in terms of rules and regulations. It's not over. It's just beginning. You have to contact your State legislators and get your feelings and opinions across to them. Actually, you're just starting. This whole process might take years.

John D. Kiefer:

I think that the approach of going to the legislature and getting the salaries of the regulatory group increased is an interesting approach. It is one that is pretty realistic, because if the natural resources regulatory people in the State are trying for increases, they generally don't have much impact. But if industry goes in and says, "Look, you're regulating this industry, which is important to the State, with people that are unqualified to do the job that they're doing," that's going to have a lot more impact.

Another approach that has been used, along that same line, is to go and talk to the legislature and tell them what the problem is. Get a certain amount of experience or qualification requirements written in to the regulations, perhaps including some kind of short course which industry could teach. "Look, we're going to teach you guys what a quarry is about, and what the problems are, and so on, what we're actually dealing with. We're going to take you down into a quarry and show you what we deal with day-to-day." Maybe a week's course like that would help solve that problem. As I said, it's a difficult problem, one that all the States deal with, and it's not going to go away.

Haydn H. Murray, Professor of Geology, Department of Geological Sciences, Indiana University, Bloomington, Indiana:

I want to emphasize a point that was made by Mike Thompson, that good reclamation can very much help a company in leasing. I was in industry for 17 years with a kaolin company, and by showing the landowner examples of good reclamation, we were able to get a number of leases that we would not have otherwise gotten. Therefore, good reclamation practices can be advantageous. So that is a very, very important point.

I want to bring up another point that Lyn Bourne made yesterday. That is that the Society for Mining, Metallurgy, and Exploration (SME) has formed a foundation to better educate the public. They are printing a number of brochures

on the mining industry designed to show the public the importance of mining, which includes industrial minerals.

Dr. Charles J. Mankin:

I would like to echo a comment that Ken Luza made earlier concerning planners. One of the things that I noted, some 25 years ago when I became State Geologist, was that 95 percent of the people in the State of Oklahoma didn't know we had a State survey, and the other 5 percent didn't care. So I felt that it was important to get some improved visibility for the organization in the State in terms of what its constitutional responsibilities were. We were chartered in the Constitution upon Statehood and charged with rather specific responsibilities. I spent a good deal of time trying to develop communication with other State agencies, with the industry, and with various groups around the State. This is an activity that the staff and I continue to this day, giving talks on, as we call it, the "smothered steak and cold pea circuit," to Lions Clubs, Rotary Clubs, various groups around the State, because I think it is very important that we communicate something about the importance of the geology and resources of our State and their importance to the economy of the State and the region.

We've had very good results. We've had good communication with the industry. We have excellent communication with our other State agencies. We work very closely with them, although we have no regulatory responsibility, and we do provide technical support services in our area of capability. But we have had no success in communicating with planners. Every contact that, to my knowledge, we have had with planners in the State of Oklahoma has been at our initiation. We attempted to communicate with the sub-state-planning districts and had limited success in that area. About the time we would develop communication with the director of one of the sub-state-planning districts, that individual would leave, and we would have to start all over again. There was absolutely no institutional memory preserved from that process. I have never had a planner in the State of Oklahoma contact me for any reason whatsoever. Every contact that my organization has made, to my knowledge, has been at our initiation. We have written letters and they largely go unanswered. We've done everything that we know how to do, and we have been unsuccessful. It is the singular failure that I can cite—there are probably other failures—but it is the largest singular failure that I can cite in the 25 years that I have been the State Geologist in Oklahoma.

C. Dudley Blancke:

I find that many of the regulations are written, I'm sure, with good faith, but they become ridiculous when you put them into operation. In the State of South Dakota, to obtain an exploratory drilling permit, you must run a survey on the wildlife in the area. They're very frightened about losing the

last one or two blackfooted ferrets. We wanted to drill in a farmer's field. We had to drill in the time of the year he wasn't using it. As soon as we were through, he was going to plow up the whole field and plant it in crops. Yet we were obliged to run a wildlife survey on that piece of property. The regulations must be flexible, and they must be open-ended and be willing to accept something different.

In Wyoming, at the Gas Hills uranium mine, they expect us to plant sage in the reclaimed area. Now, you can't go to the local farmer's market and buy sage seed. It's quite expensive. At the same time, the rancher next to our property was getting government grants to kill the sage on his pasture because of the cattle.

So, when you start looking at the regulations that all of your agencies put out, I think you had better start looking at the practical use of them.

Marshall R. Thompson:

Could someone comment concerning the status of RCRA? What's the status of that legislation?

Micheal J. Thompson:

I couldn't tell you what the status of the legislation is. All I know is that a committee has been set up that's allowing the States to have a small level of participation in the rule-making process.

Carl Blomgren:

Starting back about 5 or 6 years ago, our administrator met with the Western Governors and we [the EPA] have gone through two iterations of the RCRA. I don't believe they apply to sand and gravel and quarries. There are other kinds of mining all over the country that were a problem, but particularly in the West. The phosphate mining industry in Florida is also one. So, we've gone through Strawman One and Strawman Two, which were drafts of proposed rules to establish mining waste recovery programs in the States, with EPA oversight under Subtitle D of the Resource Conservation and Recovery Act (RCRA). Now there have been three meetings of interest groups (environmentalists, industry people, and Federal and State government people) that have been held across the country. I think there was one in Washington about a month and a half ago [mid-1991], and there's one scheduled in Denver and one in San Francisco.

Now RCRA is also up for reauthorization, and there will be some question about whether Strawman Two can be tied in to Subtitle D. There are two areas of regulation involved—Subtitle C concerns hazardous waste controlled under RCRA; Subtitle D started out dealing primarily with landfills. We recently revised the rules on landfills, and I saw on television on Sunday [September 15, 1991] that EDF (the Environmental Defense Foundation) doesn't like the

rules. There's some question whether Subtitle D gives adequate authority to adopt any regulations like Strawman Two. But RCRA is up for reauthorization. I don't know what the Congress is going to do. About the three meetings I mentioned, I've gotten the minutes from the one in Washington. If anybody's interested, you can circulate a sheet and sign up and I'll send you a copy of those minutes. There was a lot of discussion, and industry people were present. The meeting was set up under some authority that the Congress had given for setting up groups to discuss mining issues.

The Strawman Two is about 2 or 3 years old, the Strawman One is 2 or 3 years—it seems to have a life of its own, but I don't know where it's going.

Robert S. Joice:

I want to make a further comment on communication with planners. Recognize that, at least in Kentucky, and I think it's true in many States, there is no statewide planning organization as part of the government. There is no department of planning for the State of Kentucky. There are no city planners or urban planners or even regional planners who work for the State of Kentucky. There are a few planners in the regional districts, which in Kentucky are Area Development Districts, but not every regional development district has one. In summary, over half of the counties in Kentucky don't have planners. But where there are planners, let me suggest what you should do. You should go out, seek them out, try to communicate with them, and particularly provide information as was shown for Kane County, Illinois, and in Kentucky. The geologic information gives us better information to help work on a plan and get integrated into the plan. Even if the planners leave, the information may remain and be useful. One of the great statements on behalf of planning made in the 19th century was, "Make no little plans," you should make big plans. They stir man's imagination, and they last much longer than the planner. And, if you can get your geologic information in a plan as they appear to have done in Kane County, it will last, and it will be used the next time they make a decision about a quarry. Even if the planner is long-gone, that important and comprehensible information is there.

Don O'Donniley, Director, Jefferson County Planning Commission, Hillsboro, Missouri:

That certainly made my job a little easier. I think those comments are particularly appropriate. It is true, very few States have planning at all. I keep wondering if some of these issues we're talking about pay you to really assign them to the appropriate levels of government. Some of the issues about site-specific regulations sound as though we have States trying to regulate where it really ought to be a matter for local regulation. Some of the issues about not being able to communicate what the basic economic needs

are suggest that we have a failure to communicate the essentials of the economic base of the entire State. It would be more appropriate to address these issues at a State level.

Planning grew out of an urban environment, out of the police power protecting adjoining property owners against the adverse impacts of other uses. And really there hasn't been a lot of thought in our country because of our fear of central planning and central regulation about positive economic growth. The French do a much better job of this. Lots of other western democracies do, but I think there are some issues here about having State planning. I think it's a short-sighted aspect of our society not to realize that there are critical concerns at a State level that need to be addressed by a professional staff. Not one that's just limited to planners, but a planning effort in a variety of fields that would begin to address the issues that have been brought up here, and some others as well.

Anthony M. Bauer:

I would like to make one comment that is slightly different from the present train of thought. It ties into both the environmental issue and the education issue. One of the things I've found is that people perceive mined land as being useless. The public doesn't realize how much mined land has been developed within their own communities. I studied parts of two communities, Toronto and Detroit, by looking at historic photographs, maps, and USGS aerial maps. I found a remarkable number of mine sites that were identified in the earlier documents but were lost in the most recent maps. We followed through on the work and found that these "lost sites" had been converted into beautiful subdivisions, school sites, church sites, parks, and residential areas. There is a tremendous reservoir of information right in your local community. If you look at some of the historic data, you will find numerous examples of reclaimed and developed mine sites.

A side note, I visited one rather beautiful residential lake-oriented project. The mining was started in the fifties and was developed in the seventies and eighties. I talked with some of the people living in the development, and they were upset, almost to the person, when they found out they were living in a gravel pit.

One bit of information that we can use in illustrating the development potential of mine sites is the historic data in urban areas, because when these urban areas started, the operating mines were a lot closer to the center of the city than they are right now. It is a good source of data for building a case for how mining operations have always been associated with urban growth and development.

John D. Kiefer:

In Kentucky, I might add, our problem usually is not in finding old pits and quarries. Especially with the quarries, if you have a water table in the right position, leaving the

quarry as a lake and designing a park or subdivision around it is a nice idea. In some cases here in the St. Louis area, I understand some quarries have been used successfully for landfills. But in general, our problem is that the quarry leaves a big hole in the ground, with a big high wall which is dangerous and creates a liability situation, and there is not a whole lot you can do about it. I'm interested in what somebody commented on yesterday—contests that were conducted for architectural designs for reclamation. I would like to see some of the things that have been recommended for dealing with that type of quarry.

John A. Taylor:

I'd like to address Mr. Kiefer's comment on leaving a big hole in the ground.

In Breckenridge Park in San Antonio, there is a tremendous big hole in the ground from a quarry, with sheer, straight sides. They built the most beautiful Japanese gardens in that, back before World War II. Adjacent to it is an opera amphitheater, and the walk along the high edge where one can look down below and finally wind down into it, has been designed as part of the beauty. During World War II, they converted the name from "Japanese" to the "Chinese" Gardens. But now it's back to "Japanese" Gardens again, and it's a joy and a beautiful place. Nothing but a sheer wall, quote, dangerous, unquote, hazardous hole in the ground, until they did that.

John D. Kiefer:

I have to comment on that because I find that interesting. About 3 or 4 years ago, I attended a meeting in San Antonio, and one of the field trips there was to another large quarry in San Antonio. The situation there was similar, the quarry had been donated to the city to use as a park, but it hadn't been developed because they were wondering how they were going to handle the large high wall. Already a couple of children had climbed over the fence and fallen and had been injured. The city was very much concerned about the liability problem. So, that solution doesn't always work out successfully.

Ira R. Satterfield:

I would like to address planning a little bit. We at the Missouri State Survey have had some good relationships with planners. They have come to us and we have been involved with them. Back in the mid-seventies we brought all the planners in the State together at a Workshop. At that time there were 20 planning districts. We brought the planners to Rolla, where our agency is, and went through all of the things that we thought we could do to help them, from geological and hydrological aspects. Out of that, a lot of fruitful things came. One of them, a Charles County report,

was done back in the late seventies, a complete geologic resource and environmental assessment of that county. We have been involved in Perry County where Kent Bratton, a planner with some geological background, who was here on a panel yesterday, realized that our services could help them plan; and Perry County utilized our services. In some cases the county actually paid us to do specific projects. Also, we have contractual agreements with other planning districts and counties to do geological and hydrological studies. The Survey has what we call geologic-hydrologic county reports. These reports contain maps at 1:100,000 scale. There are between 12 and 15 individual maps—maps of basic geology (rock, surficial, water, hazards, wells, etc.) and interpretive maps showing assessments of minerals and potential environmental problem areas. All the maps are GIS products at 1:100,000. Kent Bratton asked at lunch yesterday if the Survey would consider Cape Girardeau County as the next county report. Well, as a matter of fact, the Survey just completed a prioritization of counties for about the next 18 months. After that Cape Girardeau County could be a good candidate.

My point is that some planning districts, counties, and agencies are utilizing geology, and I think it's up to us to begin to publicize how geology fits into their planning. I don't know who it was yesterday, it may have been Bob Joice, that indicated that the planners are having a meeting here sometime in the future, a national or sectional meeting. I think these are opportunities where we ought to try to make our point, as geologists of State Surveys, to get on their agenda and communicate with them what we do and how our services would fit into their work.

D. Anne Lewis:

In October of this year [1991] in Kansas City, the American Society of Landscape Architects is having a national convention. Within the professional society there is a reclamation committee. Tony Bauer is on it, I'm on it, and many people who think about the issues that we've all talked about this last day are on it. In my capacity as a Commissioner, I've alerted some of the coal mine industry that they might put on a mine tour for those interested parties. Thus far, we have no one from the industrial minerals contributing in any fashion. I know that the original request that went out indicated we'd like to have a non-coal tour, as we have seen quite a bit on coal. Is there anyone who wishes to somehow contribute to an education session at this national convention in the spirit of sharing?

John D. Kiefer:

I might put a plug in for going in the other direction—the Geological Society of America, to which many of us geologists belong, has a geology and public policy committee. I think we're hitting on something that we need

to do, we need both to educate each other and to get some interchange among the different groups. For example, we need to get some planners to come in and talk at our meetings, and vice versa—some geologists at the planning meetings, at the landscape architects meetings—and we need to tell each other what some of our mutual problems are and how we might be able to better cooperate.

John F. Schmidt:

John, you had asked about the Landscape Architects competition that is sponsored by the National Stone Association. I believe Anne Lewis alluded to it yesterday. I'm sure that if you contact Bob Bartlett, the Association president in Washington, he would be happy to supply pictures. In addition, the National Stone Association puts on an annual "About Face" competition for their members to improve quarry appearances in their communities. They have various competitions to improve the entrance to the quarries, maybe some screening to shield the community from some of the things that aren't quite as pleasant appearance-wise. We are trying to address those things through our national association.

Timothy S. Hayes:

The final panel addresses the subject of the environmental costs of ignoring geologic and resource information, and the leader of the panel is Dr. Charles Mankin, Director of the Oklahoma Geological Survey.

ENVIRONMENTAL COSTS OF IGNORING RESOURCE DATA

Panel leader:

Dr. Charles J. Mankin, Oklahoma Geological Survey, Norman, Oklahoma.

Panel members:

John A. Young, Deputy Division Director, Division of Environmental Quality, Department of Natural Resources, Jefferson City, Missouri.

Joseph P. McGuire, Environmental Engineer, Martin Marietta Aggregates, Midwest Regional Office, Topeka, Kansas.

Dewayne L. Knott, Biologist, Environmental Review, U.S. Environmental Protection Agency, Kansas City, Kansas.

Thomas G. McSwiggin, Permit Section, Division of Water Pollution Control, Illinois Environmental Protection Agency, Springfield, Illinois.

PANEL PRESENTATIONS

Dr. Charles J. Mankin:

I hope all of you understand the problem that the fifth panel has, being the wrap-up panel for this session. As I look over the comments of the first four panels and all of the audience discussion, I'm having great difficulty trying to figure out what we can say that is new and different, or how we can say what has already been said in a new and exciting way. So we have a real challenge for us and if any of you have any ideas, I'd be happy to relinquish this slot for someone who would like to take a stab at it.

I'm obligated by the Association of American State Geologists at every public gathering to make some comment about geologic mapping. I won't further dwell on that matter because we have already said a lot about it. I will only leave you with the comment that we still believe it is the number-one priority for geological activity in this country.

I can't help but think that two bumper stickers I saw in Washington this past spring seem to encapsulate all the issues that we have been talking about yesterday and so far today. Most of you have heard or seen these two bumper stickers in the past. One of them said, "If it can't be grown, it has to be mined." And the other one said, "Mining-free, in '93." I think we have a way to go before we bring these two disparate groups together at a common place for discussion of some compromise between those two positions.

I'm also reminded of something with which all of you are familiar. But, unfortunately, the general public is not, and this goes to this heart of this issue of education. I would like to comment on that before entering into the principal topic that we were supposed to address today.

There's one act passed by the Congress and signed by the President of the United States that has received very widespread public support. That one act has removed more land from other potential uses than all that mining has affected since this country was founded. That act is the Interstate Highway Act. That act would receive, obviously, widespread public support. I can't help but note that without mines, that system would not exist. Yet, for the most part, the public is totally unaware that there is some connection between mines and something as important to the freedom of the motoring public as the Interstate Highway Act.

Our topic today is the environmental costs of ignoring resource information. That's a fairly broad subject. It has a kind of negative connotation, which is unfortunate. We'll try to put, as they say in Washington, a "positive spin" on it. Obviously, such issues range from the very immediate to what we might describe as deferred environmental costs. Let me just talk quickly about two examples, then turn to the panel for their observations on this particular subject.

One example that comes to mind is the city of Denver, Colorado. Denver has been a rapidly growing metropolitan area for a number of years. It's sprawled out over a lot of

mesas and a lot of areas along the Front Range of the Rocky Mountains. Because Denver, like a lot of other cities, has had little or no planning that has involved a recognition of the importance of resources, most of the areas of the best sand and gravel deposits in that region have been covered up by subdivisions. So it is necessary, in further expansion around Denver, to go to areas where mining will have a greater environmental impact in acquiring sand and gravel or aggregates than would have occurred had some planning taken place—to set aside for resource development and sequential use some of the important sand and gravel deposits that now are under houses. In the development of the new airport near Denver, Colorado, there is the possibility that the supply of sand and gravel for the construction of the runways and other related taxi-ways, and parking facilities, and roads, and so on, will have to be obtained from Wyoming because that may be the closest source of available material. My suspicion is, knowing something about the geology of that area, that there must be appropriate sand and gravel deposits in the area around eastern Colorado, in the vicinity of that airport. Unfortunately, no detailed geologic mapping exists for the area, so we don't know if there are any sand and gravel deposits there or not. I will leave that as my one plug for a continued effort on geologic mapping.

Let me just talk quickly about the other end of deferring environmental costs. As you know, as many in the industry know, it is increasingly difficult if not impossible to site a new cement plant in the United States. Fugitive dust problems and other issues relating to the production of cement are making it exceedingly difficult to do so. Most of us in this room probably know, but the public is unaware, that there has been an increasing migration of the cement industry to Mexico where environmental regulations are substantially less, and where we are now obtaining a significant portion of the cement that is being used in the United States. We are transferring our environmental issues into Mexico, which is not dealing with them in the same manner that we [the U.S.] are attempting to deal with them. We are putting the domestic cement industry on an uneven playing field with the importation of cement that is produced under a different set of environmental and health and safety regulations than that which is being produced in the United States, and, therefore, continuing to make these operations less and less financially attractive. That, of course, we could extend to other industries: the steel industry (you know we used to have one of those in this country), the glass and ceramic industry, and a few things like that. What we are doing by these processes is that we are "protecting our environment at the expense of the environment of others."

The last time I looked, Planet Earth was one structure, and we all seem to live on the same planet. So screwing up the environment overseas or in an adjacent country in an effort to preserve ours makes very little long-term sense in my judgment. We don't seem to be too concerned about that, and as a consequence, it seems to me that ignoring resource

information and ignoring the consequences of these issues, in fact, encourages the idea behind "Mining-free, in '93." We're not going to quit building highways or repairing highways or constructing buildings. There are not enough caves to go around, and we killed all the buffalo so there are not enough hides to build tents; so we're going to have to mine or obtain from the ground those materials to continue to maintain our society. If we don't get it from the United States, we'll have to import it, and thereby mess up someone else's environment. I would hope that we could begin to understand that in a broader context; some of the myopia of the "NIMBY" syndrome, not only of "not in my backyard" but not in my State or not in my country, has to be tempered with the view that if we really don't want these things to happen, we ought to recognize that we shouldn't expect to benefit from those activities.

John A. Young:

I'm Deputy Division Director of the Division of Environmental Quality, one of five divisions within the Missouri Department of Natural Resources.

I've been with the Department for 18 years and in this position about 5 years. We carry out all of the basic environmental regulatory functions for the State of Missouri. We regulate all of the hazardous wastes, solid wastes, air pollution control, land reclamation, soil and water conservation, public drinking water, and water pollution. We also have a laboratory plus an environmental emergency response team. That gives you the broad scope of our Division.

I was struggling with what to say before I got here yesterday, and after listening to all the topics, I'm struggling even more because most of the things have probably already been said. I would like to make just a couple of comments on some things that have already been raised.

Yesterday, there was a speaker who commented, "When we want regs, we just go pass them." In other words, we do this without any problems and without any difficulties. I am a survivor of something that was less than "we just go pass them." Anne Lewis, the Chairman of the Land Reclamation Commission, who has the promulgation authority, alluded to this earlier. Most States have an administrative rules committee made up of members of the General Assembly. I don't know if all States have that or not. What happened in Missouri was that there was not as good an attempt as possible to work with the industry on the implementation and writing of regulations to implement an amended land reclamation law. In about September and October of 1990 the staff of the commission went forward with about a 62- or 63-page proposal. Apparently there were miscommunications or poor communications that ended up with the proposed regulations being thrown back at us by way of the Administrative Rules Committee. The Commission was then saddled with "Well, what do we do next?" I was enlisted, or maybe volunteered, to participate in a work

group that met from January through May of this year [1991]. At least one of the members is here today that participated in that committee. We had a struggle in developing those regulations over whether to have one set of regulations that regulated limestone, sand and gravel, clay, and barite, or to have more than one set. We decided upon a single set, which was very difficult to accomplish. However, I am pleased to announce that there was a consensus among the limestone people, the cement people, the clay industry, and the sand and gravel people. They recommended regulations (with a couple of minor exceptions) to the Land Reclamation Commission, and the Commission is in the process of finally proposing those regulations. So the comment that someone said, "Let's do it up front," is vital—I think it's obvious that it's important to do that.

My personal experience was that removing the association presidents and lobbyists from the negotiations on regulations and dealing directly with the people who knew exactly the problems that were presented in their mine locations, whether it be a clay pit or limestone quarry, allowed us to get down to business, and we ironed the regulations out. So I would encourage all the States' regulatory agencies to try and approach this, directly with the guys who make their living extracting the mineral. Talk to them about the problems and the reality of implementing regulations.

Another point I want to make is that public relations has to be emphasized quite heavily. We do not regulate blasting in the industrial minerals sector in Missouri, but we do in the coal mines because of the Federal act. A majority of the mine operators, in my opinion, can improve their public relations. This does not apply to all the people that I've worked with, but I'll give you a quick example of what I mean. We got a call last week from a neighbor to a quarry, and she said, "They're throwing flyrock into my front yard and my kids are playing there; it's a dangerous situation." Of course, we had to explain that we don't regulate blasting (the people we referred them to are in mine safety, and sometimes that is not very productive either). The comment that was made, though, that is frustrating to us, is that the quarry operator was reported to have said, "Okay, we'll tell you when we're going to blast, so you can go inside your house." That is not good public relations, and that does not give industry a good image for being good citizens.

So, we have people in the industry that, frankly, don't give a damn about their neighbors, and I think those are the people we need to bring into the fold and get them to understand the value of good public relations. They do not characterize the industry in Missouri, in my opinion. I think that was a very isolated example, but that kind of comment can do a lot of damage. There was a previous comment about 2 percent versus 98 percent disclosure—well, that 2 percent becomes a serious problem in an instance like this.

Let me give you one other quick overview. There are 311 permits presently for industrial minerals operations in Missouri, covering approximately 1,000 sites. We have

several sites in any given permit. Eighty percent of those are limestone quarries, about 10 percent are sand and gravel operations, 5 percent are clay operations, and the others are made up of granite, barite, and others, about 15 mining operations. The majority of Missouri sites are in the 5-acre or less range. Although there are a lot that are considerably bigger than that, they do not make up the majority of the 1,000 sites. As a matter of fact, in the flint clay area south of the Missouri River, most of those sites are even 1 acre or less. So we're not talking about a major land disturbance in a lot of cases.

One final comment I might make about remarks made in the discussion earlier when it was alluded to that in the State of Missouri we don't know what we're doing as a regulatory agency. I would have to take exception to that. We have made an attempt, specifically, to have our air pollution people visit sites, and some of the people in this room have had tours of their facilities by our air people. It is acknowledged that some problems can be created by turnover in agency personnel. The other thing I would point out is that about 2 years ago, we implemented and expedited a permit process across the board for all environmental permits. In the air pollution field we have done an exceptional job of getting permits out within the statutory time limits. The facts aren't the way they were portrayed in the discussion following Panel 4. That is not to say that we don't have things that we need to take care of and that we need to become better educated about. We will do that as we learn what those problems are.

I'm not sure how to totally solve the problem of inconsistent inspectors. We didn't have too much inconsistency for about 15 years in land reclamation areas, because we have one inspector and he did it one way. That's how much (how little) resources we have. For 1,000 sites, for 311 permits, we have had a secretary and one technical staff member who issued all the permits, did all the bond release reviews, etc. We are probably having some growing pains, because we already have four or five staff people now for these 1,000 sites. So inconsistencies are there. They can only be dealt with if we are made aware of them; I would leave it at that.

Now, one of the things I came to talk about is a difficult topic. What I'm going to say will probably bother some of you, but I think that we need to be thinking ahead. In 1971, in our first Land Reclamation Act, there was not a requirement dealing with topsoil removal. So for 18 or 19 years, in Missouri, we had hundreds of mining sites that did not remove and save topsoil, or if they did, it was at their own discretion. Many of them did not, and that is a lost resource. Whether it fits in the category of the topic today, we hope that that's past and it will not happen in the future, because one of the things that the new Act did was to require topsoil removal and replacement for reclamation purposes. I would point out that many of the people in the mining industry probably aren't aware and do not utilize things like public soil surveys and information that is readily available from

government agencies. I think that lack of use probably prevents them from appropriately planning for saving a very valuable resource, "topsoil." This may sound a little silly that you go hundreds of feet in some places to get your material but that first foot or two can be critical to the success of the reclamation. If the topsoil is set aside and used at the end of the process, then reclamation is a snap.

There are three areas that I would suggest you should consider checking into, maybe even before it appears that you're into a controversial situation, either at a resource agency or possibly hiring a consultant, depending on the price. I realize the price of the product is very high, so extra-neous expenses would be scrutinized very closely.

First, threatened and endangered species. There's a tremendous amount of information in the resource agencies to help you find out a little bit about what might be in your area.

Second is cultural resources. There is information available in the State agencies about cultural resources. We have found that these issues have to be dealt with. At a recent meeting I was with a Ponca Indian from Oklahoma, two Indians from Iowa, plus other citizens against a landfill. The Indian Nations are becoming more active across the country in part because they are interested in burial mounds, in archeological sites that may be tied back to their ancestors. I would suggest to you to take a look at that issue before it's thrown in your face at a public hearing. Have a letter from the Cultural Preservation Officer or someone that basically clears that site from being a significant archeological site.

And the third issue, wetlands, is undergoing a great national debate right now. You probably should check in the planning stages with the four Federal agencies that deal with wetlands. We've had good success in Missouri in getting the Federal agencies out on various projects to identify whether or not you truly have wetlands.

These may be issues that companies look at all the time, and I think the more sophisticated companies do. However, when you look at 311 permits in Missouri, I can guarantee you, there are a lot of companies that aren't very sophisticated and probably have a very small staff that wouldn't recognize the need to even look at these issues.

So how do you prevent problems? First, preplan on some of these issues, or if you don't you might not operate. Secondly, investigate your environment, so that you will not destroy a resource that you will regret having destroyed and which may get you in legal difficulties. My experience in working with the mining industry is that there is mistrust about coming to any agency, Federal or State, and saying, "Hey, I'm planning to do this. Could you tell me a little bit about the area?" They [companies] really don't want to do that. That's my personal experience. Some of you may do business differently than that.

That is difficult for us to understand, at times, maybe because we're on the regulatory side of the equation. However, I think that we would all be better off, if we can work toward a better way for the people of the industry to come to

the State or Federal agencies just to gain technical information and not initiate an adversarial situation.

We have discussed internally providing a technical resource section within the division, so that we can give out basic information without arousing the “Hey, they’re about to do something in this area,” response and without having repercussions in the industry from the agency contact.

Dr. Charles J. Mankin:

Thank you, John, we appreciate those remarks. You have identified some important issues that need to be considered; there are related resources in connection with the primary commodity that the mining operation might be undertaking to achieve, so recognition that there are other resources of a cultural nature or endangered species is important to consider. We’ll hear a little later from the panel about related issues on water, but our next panelist is Joe McGuire, Environmental Engineer of Martin Marietta Aggregates.

Joseph P. McGuire:

As this is the last panel, and as we are the last presenters, I really didn’t know how much more I can say after what Mr. Young has just said. And so I’m taking off just a little bit differently here.

I handle environmental concerns with Martin Marietta, permitting concerns for pretty much the Midwest—mainly in Kansas, Nebraska, Missouri, Iowa, and Wisconsin, and I’ve had some dealings in South Dakota, Minnesota, and Oklahoma. This has given me an opportunity to deal with a multitude of agencies at various levels.

I’m going to come a little bit from the operator’s side in dealing with Dr. Mankin’s paper, which talked about mapping deposits to protect them and to use them for future. The classic example he gave, which was also mentioned yesterday, was Denver. Sometimes, I feel like we in the industry might take a bad rap in some regards for moving from one deposit to another. But in the last few years, because of environmental groups and encroachment of residential areas on our mining sites, we are oftentimes forced to leave an active deposit because we can’t get the permit extended or are unsuccessful in getting other deposits. I think the loss that Dr. Mankin was alluding to is that we not only lose the deposit, which is a very important part of the environment, but as we move from that deposit, we disturb another area. So from the environmental cost, I think that issue is very important. Mining can only be done where deposits are and where we have the ability to effectively mine them.

I’ll pose a question to the folks in this room. It would seem to me that if a mineral deposit is identified by a group like USGS, and if a mine operator presents a reasonable, responsible plan to mine that deposit, and if the regulatory agencies involved review that plan, and in their opinion, see

that it would be appropriate to mine it, why are mine operators all across the country losing these deposits because we can’t obtain the permits? Because of pressure from environmental groups or a few neighbors. If this is important to the public and a benefit to the public, why are these deposits being lost forever?

It would seem to me that this trend of losing deposits needs to be fully evaluated by a group like this and a strategy needs to be developed to reverse this trend of losing mineral deposits forever.

We, as operators (and we have heard this a couple of times), are asked to bring plans that are responsible and are environmentally sound. We are asked to support our position with documentation, and are asked to be quite truthful when we present our information in the various hearings. But it seems that even when we as operators do this, we go to the hearings and we still lose even though the plan is reasonable and it’s responsible.

Based on my experience of working in several States with several planning commissions and other regulatory agencies, we lose to those groups or individuals who come to hearings and present information or accusations that are unfounded. The question I’m asking is, what do we do as operators to work with the groups to reverse this?

I felt a little bit uncomfortable as I sat through the panels yesterday. I seemed to sense a little of an adversarial role between regulatory agencies—particularly the planning and zoning representatives and the operators who spoke. I feel, personally, that is not the case. I’m currently working on my dissertation at Iowa State. My research has been focused on the area of regulatory agencies, specifically planning and zoning. As part of my research, I developed a questionnaire and sent it to 194 licensed aggregate producers in the State of Iowa and to the planning director, and (or) his designee of all the 99 counties in Iowa. I am currently extending this research to Kansas. I want to share just a few things, preliminary kinds of things, that I’m finding out. I had a 47 percent return rate on the questionnaires. I was pleasantly surprised by the number of counties that responded; out of 99, I had a 74 percent return rate. In Iowa aggregate producers’ returns, the rate was 32 percent. The problems identified by the aggregate producers were blasting, dust, traffic, and reclamation. Public officials identified the same kinds of things, blasting, dust, traffic, location of the mine site in relation to other existing land uses, water concerns, visual intrusion (meaning the impact of the mine site on surrounding area), and reclamation. In the questionnaire I tried to identify what factors contribute to where the mining industry is today. Both groups, regulatory agencies and producers, indicated that mining industry operates somewhat irresponsibly. In other words, we probably don’t operate as best we can.

The lack of information provided to those involved or impacted by mining operations was a very important factor. A lot of the image of the mining industry today is a result of previously unregulated practices. That is an important factor.

Another factor contributing to problems as the industry sees it, is an increased awareness and pressure from environmental groups.

During yesterday's panel discussions and even more this morning, we touched on inadequate mine plans and reclamation practices. My research indicated a way for both operators and regulators to resolve some of the concerns. Operators need to become more responsible, they need to develop and improve reclamation practices, develop and use sound mining plans, and work closer to regulatory agencies. Both sides need to provide educational sessions, focusing on issues. From my experience in dealing with planning and zoning folks and other agencies, I strongly agree with some of the comments that were made. Do that from the beginning, share what you're doing, work the process. That is what it is. It is a process. Obtaining permits is not a thing of "do this, do this, and do this." It is a process that begins here and it deals with the term "final reclamation," or "final use plan." In several very heated permit processes that we have gone through, we have worked with the planning and zoning people and with those individuals who felt that they might be impacted. We succeeded if we dealt in terms of a final use plan, a final reclamation plan. Rather than submit something in 1991 which deals with the final use and defines what this place is going to look like in the year 2050, we are questioning whether a 1991 plan is the proper final use for that land 50 years from now. Shouldn't that "final" plan be involved in moving toward a concept of what might happen? We used that several times in working with planning and zoning, and it really works. It is a good way to approach neighbors' legitimate concerns about what is going to happen. I think we would probably be more honest, as operators, in talking about a concept versus something in black and white, that none of us will be around to see.

Dr. Charles J. Mankin:

Thank you, Joe. Joe brought up some interesting points; certainly that point dealing with the issue of being required to abandon existing mine sites because of the encroachment of other land use of presumably higher value is one that needs to be addressed. Preventing continued recovery from an existing resource and requiring that organization to relocate an operation does, in fact, involve environmental costs. It has seemed to me for a long time that some effort ought to be made in the planning process to recognize the existence of a mining operation and provide some protection for its continued existence in an area.

In a related example, not dealing with mining at all, but just an example that illustrates the point: In Norman, Oklahoma, prior to World War II, a small airport was located in the town. Around that airport was a large, set-aside area for protection of the airport. Construction in the flight paths was not allowed at the end of the runways in order to protect the citizens from the possibility of

small-plane accidents. Unfortunately, the city in its infinite wisdom has now allowed development of the approaches on the south side of the airport. As you can imagine, there is great consternation on the part of the citizens who have bought homes in that area that, in fact, this airport is now endangering their lives. The airport existed long before that area was developed. It is an area that had been set aside, but unfortunately developers were able to convince the city's planning commission that that area should be developed. Now development is in competition with the airport, a lot of unhappy people are not existing in a cooperative way with the airport, and there are those who are working very hard to get the airport closed down.

The next person on the program is Dewayne Knott from the Federal Environmental Protection Agency.

Dewayne L. Knott:

By way of introduction, I feel as though I come to this panel fairly well rounded in that I spent 10 years with the U.S. Army Corps of Engineers. Seven of those 10 years were spent as a field regulatory person, a wetlands biologist. I've spent plenty of time in quarries, plenty of time on dredging operations.

I've seen how it works, and I've come to understand your needs and the problems that you face. And, whenever I met with you, I tried to cause you to understand the problems that I faced, coming from a regulatory agency. I now work for the EPA and have for the last 3 or 4 years, and I'm looking at the same questions as I review environmental documents. In addition I have spent 22 years working one way or the other with the Air Force as an Environmental Officer and have a fairly solid foundation with environmental regulations.

I found it interesting that I was asked to be on this panel discussing resources. I just recently returned from Kuwait where I was working in the oil fields, and I'm not too sure that when Saddam Hussein lit those fields that he was thinking too much about the consequences of his actions either to the resource commodity itself or the damage done to those fields, as well as to the environmental and ecological resources involved.

I have been sitting in the back of the room the last couple of days, and I couldn't help but notice the number of graying and balding heads, my own included. I did a little figuring, and it occurs to me that there is probably somewhere upwards of a thousand years of experience and knowledge sitting in this room. That's impressive. I feel like this panel and perhaps the panel before have been a little bit like preaching to the choir. Because you are here, you're taking some action and interest in planning and in resource responsibility, not only from your own points of view in extracting the resource but also in protecting other natural resources that can be damaged during that extraction process.

It scares me a little that I don't see very many young faces in this room. Someone on the previous panel mentioned

corporate knowledge and a memory bank of corporate experience. I don't know if you guys left all the young people at home to run the place while you're here in St. Louis having a good time, but it's a little bit scary to me.

There are all sorts of resources. There is, of course, the product resource, the resource that you extract from the ground. But there are other types of resources that I want to talk about. There's a dynamic, living resource that includes terrestrial wildlife, animals, insects, plants, fungi. There is also aquatic wildlife, including fish, plants, insects, and amphibians, and also the avian community. If you don't think that any of these critters or plant materials can cause you a problem, all you need do is look at the experience with the snail darter, an example which is oft-used and probably most known, and more recently, the spotted owl, which brought two very large operations, in one case a project and in another case an industry, to a halt.

Regardless of which side of the resource issue you find yourself on, the fact of the matter is reality, and reality is that those concerns are with us. They are with us as regulatory agencies, and they are with you as producers.

Another group of resources that I want to mention are static resources, which include soil, air, and water, and a resource that I haven't heard mentioned yet is aesthetics (vistas). This is a resource that needs to be considered in your planning process. What is this place going to look like while you're there, what's it going to look like after you have gone? Quiet is a resource. There is probably not a person in this room who at one time or another has not said, "I wish I could find just a little peace and quiet." It's a valuable resource, and it's getting to be more and more valuable in our society. All you need do is step out the door of this hotel and hear the din of the freeway. It's something that you need to look at, and you can be good neighbors in that regard. Chief among the static (nonliving) resources is water. And I believe Tom is going to address that here in a few minutes.

I have a suggestion to help you in your planning process; I heard you talk an awful lot about planning. Twenty years ago this last April I believe it was, the National Environmental Policy Act was passed by Congress, and what that Act basically did was hold the Federal government's feet to the fire of its own environmental policies. That Act has been around for 20 years, and even though you are private producers involved in an industry that is not federally funded, you still can use this document as a planning tool. You're not bound by it, and it isn't a law you have to observe, but is a good planning tool. You can use this Act as a guideline in developing your own scoping and planning process. It takes you step by step, and if you follow the NEPA guideline, you will probably serve yourself well. The reason that use as a guideline is important is because the Act engages in the alternative decision-making process. We've already talked about the Clean Water Act and under it, Section 10 and Section 404, but you have the Endangered Species Act, Fish and Wildlife Coordination Act, Farmland Protection Policy Act,

National Historic Preservation Act, Wild and Scenic Rivers Act, the Wilderness Act, Wetlands Protection, Floodplain Management, and others. The NEPA document can help guide you through all of those.

I want to reinforce a statement made earlier. Don't be afraid to come to the State or Federal resource agencies and ask us for information. The Fish and Wildlife Service has ready lists available on threatened and endangered species. And the State has lists of State endangered and threatened species. Ask them for the lists. The Historic Preservation Office can help you with cultural concerns. Likewise, other agencies have information and help available to you that can answer your resource questions.

Dr. Mankin was right when he spoke of the planet Earth and the "Not in My Backyard" syndrome. Out of sight and out of mind simply does not apply any more. The Earth, which is the only home we have, is also the only backyard we have.

Dr. Charles J. Mankin:

Thank you, Dewayne, you brought up some interesting points for additional discussion. I'm sure it will elicit some comments from the audience. The issue of water is one that has not been widely discussed at this meeting, and yet it is critical to everything that we do. The protection of water resources, as a part of the mining process, is something that has to be done, not only because it is the law, but because it is the right thing to do.

Following as the wrap-up person for this panel, who will elaborate further on the issue of water and other matters, is Thomas McSwiggin with the Illinois Environmental Protection Agency.

Thomas G. McSwiggin:

In my section we have permit programs that deal with the subject of water, and most of the efforts that we put forth are in the NPDES which is directed only towards surface water. We deal with some 2,500 NPDES permits across the State. Of that 2,500, probably less than 200 are related to the mining industry, and of that 200, perhaps 75 or 80 are directed toward the coal industry, which, incidentally, receives most of our attention from that portion of the agency's resources that we do devote to mining. The reason for that has been that over the past 14 years that I've managed this particular program, water has been a subject that has never really attracted any particular spotlight until somebody ended up with his well dry because the quarry or limestone or gravel pit next door dewatered it. That's a resource issue, and it's one that is brought to us quite often, but unfortunately, it's one that we cannot deal with because we are basically a quality-of-water not a quantity-of-water agency. It's a rather difficult story to explain to the person at the other end of the telephone line that although he's made every

attempt to find an agency in Illinois that could control his problem, there really isn't any solution except to go to the local circuit court and bring his own case.

As we have moved through this period of history with the NPDES, we started looking at the surface water quality problems, and over the years we've had quite a variety of issues brought forth. One of the focuses nationally today with the NPDES permit system is the prevention of the discharge of toxic materials. Looking at the operations of aggregate production over the years, we really haven't had that many problems, except for what may seem to be a sideline for your operations and that's the handling of fuels and lubricants. It has caused us a few concerns here and there, particularly as we've had some releases of these materials due to improper handling, basically storage. For the most part, the handling has been pretty sound. We haven't seen that many problems, but we've had cases of overfill, and broken pipelines, and that type of thing.

But, looking ahead at the toxic aspects of surface water control, we're likely to see more focus in the future placed upon some of the waste materials that you leave at a site. The coal industry has probably been one of the prime examples for us over the years, as they leave their gob piles with the sulfur materials and acid formation taking place. We've seen some massive toxic discharges in Illinois. We've had some streams that appear to be crystal clear. You can look at every rock, count the grains of sand on the bottom, but then you note when you stick a pH meter in there, the pH is 2, and that's why it's so clear. Fortunately, a lot has been done to correct that over the years.

As we proceed, surface water is perhaps going to be our main focus. So, it gets into an issue of researching some of those incidental materials that may be in the formation that you're looking at. What would be the fate of those materials that were left to weather? And what would be the likely result of runoff from that particular site?

The other issue that is becoming more and more prominent in the public's mind is that of ground water. For years, ground water was kind of ignored by the public. They knew it was there. They never gave it much thought until it was tapped and used as a resource, for public water supplies. Particularly in northern Illinois, it is the main source of public water supply. In southern Illinois, surface water happens to be the main source because there isn't that much ground water available in economic quantities. Over the years, however, the private individual who depends on the private well has just started to develop an awareness of the resource that he's been tapping and not thinking about. We are starting to see these concerns, concerns to the point that now underway in Illinois is a regulatory effort to establish separate ground-water quality standards. These standards will set numerical limitations for certain materials and establish a procedure for developing numbers for other materials that may be found in ground water. One of the things that goes with every water quality regulation is that it is designed to

protect a use. Most surface water quality standards were designed to protect that water for what we call general use, which includes protection of public water supply, aquatic life, livestock watering, irrigation, general uses to which you could put a surface stream. More stringent regulations were basically developed for all this water supply.

That same concept is carrying over into the establishment of ground-water standards and what will be a general resource classification. Ground waters will be protected because they are a general resource and maybe some day will have to be tapped to be used for water supply as we undergo economic development and expansion of population in certain areas. Of course, there will be a set of numbers and procedures for the establishment of standards for protection of public water supply.

So we're looking at this increased emphasis. We have, to some extent, awakened America on ground water and now we are starting to see some concerns raised. I feel that we will be devoting a lot of attention to it over the next few years. In the repertoire of permits besides the NPDES, we do have a State mining permit which does focus to some extent on ground water.

In recent years we have started to ask for a closure plan. In Illinois what we're looking for is a plan that will protect the water resources in the area once the facility is closed. We really don't have jurisdiction to look at any other particular aspect of the closure such as visual, plant life, or wildlife establishment. Those are programs administered by other agencies in the State.

We're looking at a brighter spotlight over the next few years, more focused on ground water. I would like to also mention that most water quality agencies in the United States maintain inventories of surface water quality data. We have a policy in Illinois, and I'm sure some of the other States do, of sharing that data when we receive a request. There is a lot of information there. The situation on ground-water data is a little more fragmented—we don't have a lot of data available in our shop. I think the State Water Survey, which is a sister agency to the State Geological Survey, does have quite a bit of data on ground water. My experience has been that they're willing to share it as well.

So some information is available, but we seldom get requests for it unless we are dealing with something relatively big. The last time I was involved in a request looking at water quality data, was when they wanted to close Chanute Air Force Base over in eastern Illinois. It's kind of the reverse of what we normally deal with, closing of a base, but we're looking at the impact on water quality of that particular action.

Dr. Charles J. Mankin:

Thank you, Tom. This panel, has attempted, then, to identify those kinds of resources that are not commonly considered in connection with the recovery of a commodity, namely those resources that relate to soil as a resource,

wildlife, endangered species, the vistas, the resource of quiet, the resource of air, and importantly, the last two speakers have commented in particular on surface and ground-water resources. Those are important issues that have to be considered in connection with this overall process. It is because it's not only the law, but it is indeed the proper thing to do.

Let me open the floor for discussion from the audience.

DISCUSSION

Anthony M. Bauer:

Regarding the last speaker's comment, I think here is another very good example of why the industry needs to be brought into the planning process and be actively involved in the process of developing regulations to make sure that the regulations and standards distinguish and recognize the difference between various kinds of mining activities and sites. Otherwise you are going to be automatically identified with acid drainage and a lot of other unrelated issues.

I would like to comment on what Joe McGuire said about the importance of pre-mine planning. While a good mine plan is no guarantee of success, no matter how sophisticated the plan, it is becoming an essential part of the industry's effort to open new mine sites. Two years ago I received a grant from the National Aggregate Association to study mine projects around the country. There is one common denominator that has occurred, to varying degrees, across the country. It is that the planning effort is becoming more intensive, more expensive, and longer to complete. One hundred thousand dollar consulting fees on major projects are not uncommon. It is becoming a very expensive process, and very time consuming.

Dealing with the State regulators has not been a problem in my experience. They appreciate and understand the significance of information produced by qualified people. They review those data in an objective way. They have the standards. They equate these standards to the plans you present. The problem is back on the local level. What's happening across the country is that cases are prepared with an attorney on your side, in anticipation that you will lose your case at the local level and will take it to the court. The chances you're going to get local approval are decreasing. It's common in Michigan, it's common on the West Coast, it's common on the East Coast. And so the problem isn't dealing with the standards set by State regulators, the problem is not having an opportunity to deal with the issues in an objective way at the local level. I don't care what type of plan you prepared; I don't care how you approach this project; I don't care how well you developed the plan, the local communities are saying in increasing numbers, "We do not want sand and gravel operations in our back yard."

Dr. Charles J. Mankin:

Thank you. Do we have another comment?

H. Lyn Bourne:

About 20 years ago, in the early 1970's, the Colorado Legislature gave a mandate to the Colorado Survey. They asked them to map the aggregate resources within the eight most populous counties in Colorado, so that the aggregate resources would be recognized for what they were for future development plans, and so on. In spite of the success of the mapping program, it really didn't carry much weight, as Dr. Mankin pointed out. As the resources are being depleted, the ones that are geologically available are not legislatively available, and they simply cannot get permits for those.

So, there is the cost of ignoring environmental factors, you're wasting other resources. You're wasting the roads, and the railroads, and the fuel to bring a resource to market, when it's right there.

Dr. Charles J. Mankin:

Very good point. Any comments from the panel on that? Or other questions or comments from the audience? I suspect that all of you share the views that the panel has and that is, as Yogi Berra was wont to remark, "It's déjà vu all over again," and with those prophetic words, I'll close this particular session.

PANEL SUMMATIONS

Tuesday afternoon, September 17, 1991

Timothy S. Hayes:

Now I would like to go back and summarize. I've asked each panel leader to prepare a summary and each has. In order to get an overview of the past day and a half of discussion, I'd like these to be presented one right after the other. Then, in order to try to fulfill a promise that we would try to come up with some options to go with these recognized issues, I want to go back to the first summary, item by item, and see if there is an option or several options that this group would recommend and support in addressing that particular issue.

First panel, Lyn Bourne, on resource evaluation.

RESOURCE EVALUATION

H. Lyn Bourne:

In addition to the items on that list that we passed out to you yesterday, there were a couple of other items that we

want to include, based on some of the comments that we had after our presentation. One was a need to identify exclusionary areas such as wetlands. The other one that came out was that demographic data would be part of the information essential to resource availability. Jim Eidel suggests that we could probably break this list into two components. One component would lend itself to a GIS data base that would include such data as topography, geology, and location of resources, the demographics, transportation routes, physical and chemical parameters, and some of the ownership, land-use, and (or) planning maps. The second category would be things like a bibliography of theses and dissertations, permit procedures, timing or sequence necessary for permitting, and pertinent legislation that impacts the mining industry.

Based on those concepts, one issue that we see is mapping. This would involve two of the three levels of inventory that Tony Bauer suggested, public domain mapping at the State level, and certainly the 7½-minute quadrangle geologic maps. In our written article summation, we'll include some of the comments from Dr. Mankin.

The second issue that we see is a data base system that would be available (probably at the State level) that would include a lot of the items and kinds of information that will be necessary for resource availability.

A third issue is public awareness, whether this is handled as PR (public relations) or some kind of an educational exchange of ideas much as we've had here. The issue is to move away from an adversarial position of regulators and operators, and try to move toward more cooperation. We're basically all in this together, and we need to identify ways that we can work together. So as an issue, public awareness is going to be important.

One of the recommendations that Jim Eidel makes, and I concur with Jim, is that the publication that comes from this Workshop should include an appendix. That appendix, or one of the appendices, would include State regulations, possibly on a State-by-State basis, that deal with permitting, with new operations. If there is information available from the EPA, some of whose people are present here, we would like to include that in a list as part of this appendix. [See Appendices.]

LAND-USE PLANNING

Timothy S. Hayes:

Bob Joice had to leave. He was the leader of the second panel on land-use planning. He left a written list that is framed into a 1-10 arrangement, although it does have a few comments. Bob writes:

"Planning is number one, identifiable as an issue. Planning is intended and designed to be an open, rational decision-making process to protect the local community and

bring pertinent information to bear on an essentially political decision. As such, complete truth and full disclosure are essential, as is adequate geologic information which clarifies the necessity of a proposal.

"Two. Planning is only one of the ways local government relates to industrial minerals. Zoning, as a part of the planning process, focuses upon the single decision to locate and authorize the *initiation* of an activity, such as quarry operations. Zoning, thus, has limited capabilities for influencing proper *on-going* operation of a mine.

"Three. One overall objective of proper urban planning, very directly related to the preservation of mining resources and the compatibility of uses adjacent to quarries, is the control of urban sprawl with such techniques as urban service area boundaries and provision of limitations on growth inducing facilities. This should probably become a recommendation that those involved in mining should encourage good local planning, especially using techniques to control urban sprawl. Those efforts will assist in preserving mining opportunities.

"Four. As with most petitioners seeking local approval for specific land-use activity, quarry operators must recognize potential negative impacts and propose appropriate ways to mitigate them. The primary items to address are transportation impacts and environmental impacts, particularly on adjacent and nearby lands.

"Five. Although quarries are very long term activities and reclamation plans for later use are difficult to envision, such plans are critical. Communities very much want to know what will happen after quarry closure and, obviously, they want good things to happen.

"Six. The entire planning process is composed of people, those living near a site, those making decisions, and those with similar interests. The stone industry must work with interested persons openly to reach these common goals.

"Seven. Better education of citizens and planners and overall better public awareness regarding geology can only help.

"Eight. This is perhaps a two-way street where government geologists should learn more about planning and become involved in such planning.

"Nine. The primary influence of State and local government on industrial minerals appears to be regulatory. As is common in other planning areas, such as agricultural resources or historic resources, those involved in planning should be encouraged and assisted to view mineral resources as worthy of protection and preservation.

"And, ten, as with education, geologists should work supportively with planners in projects of mutual interest, particularly Geographic Information Systems or simply geologic mapping for use in a comprehensive plan."

Timothy S. Hayes:

Let's move on. Dr. Subhash Bhagwat on cost factors.

COST FACTORS

Dr. Subhash B. Bhagwat:

I'm the only one of the panel left here this afternoon. We have put together ten items that, simultaneously, may be issues, but they may be just points in some cases.

One. Cost increases with insufficient price increases have squeezed profits over the past two decades, and the result is a lack of money for research and development.

Two. There is inability or unwillingness on the part of aggregate producers to engage in public relations and inform the public about their genuine economic problems.

Three. Many subheadings of operational costs are actually beyond producer control, but the industry is not doing enough to influence them through taking to PR or other lobbying efforts so laws can be influenced at the beginning.

Four. Recycling of concrete and asphalt is here to stay. It's environmentally desirable. Industry should join in and take advantage of it and find ways of living with it instead of resigning to it.

Five. Production is moving farther away from consumption sites. Cost of transportation is often a multiple of the cost of production. Work is needed to find ways of cheaper transportation alternatives.

Six. High-quality specifications are reducing the available resources stock, but prices are not rising proportionately. That latter could be an indication that currently, at least, supply is adequate, but is it going to stay that way? That's the question we'd like to have investigated.

Seven. Underground extraction can be economically competitive under certain circumstances and should be taken into serious consideration wherever possible.

Eight. A check-off system as a means of raising R & D (research and development) money should be given consideration, with appropriate controls in place so that the industry can determine how the money is to be spent.

Nine. The aggregate industry should keep an eye on substitute materials such as fly ash, slag, and others that can take the place of naturally occurring aggregate materials. Adaptation to that situation and getting into that business on time could be very important.

Ten. Increasing quantities of fines for which there is little demand introduces a cost factor that affects the supply of the rest of the material. New ways need to be found to mine, wash, and use the fines.

Timothy S. Hayes:

John Kiefer on environmentally responsible production.

ENVIRONMENTALLY RESPONSIBLE PRODUCTION

John D. Kiefer:

The concept of environmentally responsible mineral extraction is largely a matter of perception, and your

perception is largely a function of perspective: industry, regulatory, political, planning, environmental, or general public. The only way to reconcile these differences in perspective is through communication, good public relations, education, and cooperation among all the parties concerned. Failure to do so will impact us all, but it will have the most direct and obvious impact on industry. It is therefore imperative that industry take a leadership role. The cost of doing so is far less than the cost of inaction. Act. Don't wait for things to happen and then react.

Environmental responsibility goes far beyond just meeting the permit obligations. You cannot just say that you are a part of the community, you must show that you are a part by your actions.

Industry needs to play a part in the drafting of regulations and a leading role in working with and educating those enforcing the regulations. Poorly paid and poorly trained permit writers, regulators, and inspectors seem to be a universal problem and one that won't soon be resolved. To be antagonistic and uncooperative simply makes the situation more untenable. The best policy, is, again, to meet the situation head-on by working with the inspectors and regulatory authorities to make sure that they get the proper training and are aware of the problems and constraints under which you must operate. Such steps as informative quarry tours, informational pamphlets, slides, videos, and well-designed training manuals and short courses can help. In one State, an organization of aggregate operators went to the legislature to request that regulatory personnel be paid a more adequate salary, so that better trained and more qualified people could be hired and retained.

In regulations, although the Federal agencies such as the Corps of Engineers and the Environmental Protection Agency have some regulatory authority over aggregate producers' dredging and filling, dewatering, and fugitive dust emissions, most of the regulation is done at the State level. One area regulated by EPA, which will have a major impact on mines and quarries in the near future, is in the new storm water discharge requirements. This could impose a heavy burden on industry. However, most regulatory responsibility, such as NPDES permitting, lies with the States. This puts the regulation at a more local level, which is as it should be, because the environment and conditions in each State are different. In fact, inspectors need to realize that each quarry is different, and there needs to be some flexibility in the application of the regulations.

Good long-range planning is also a key and must contain an end result that leaves a usable piece of property in the community. Lakes, parks, subdivision land, and landfills are some of the possibilities. Working with community leaders to develop long-range plans can be important in public relations and leave the community with the feeling that they are going to get something beneficial out of the process.

Finally, recycling has already been noted. Recycling must become a viable part of the industry. Recycling materials must be considered as a by-product of the operation, and it's beyond the point of that being our decision. It's a worldwide problem.

Timothy S. Hayes:

For the fifth and final panel, Dr. Mankin on the environmental cost of ignoring resource data.

ENVIRONMENTAL COSTS OF IGNORING RESOURCE DATA

Dr. Charles J. Mankin:

There are two of us left from panel five for the rest of you to pick on in case we don't properly reflect your views on this matter.

The findings of panel number five are essentially as follows. The panel identified two kinds of issues relating to the environmental costs of ignoring resource information.

The first issue is ignoring resource information related to the commodity to be mined, for example, sand and gravel, limestone, and gypsum. And the second issue is the array of other resources that may be affected by the extraction of an industrial mineral resource. That list of other resources includes such things as soil, surface and ground water, wild-life endangered species, cultural, vistas, air, fossils, archeological, and the list goes on. Ignoring commodity resource information in the planning process can lead to land-use practices that prevent access to those resources. This, in turn, can lead to the development of those commodities elsewhere at greater environmental costs, and we cite here the Denver example.

Ignoring the existence of resources that can be affected by mining can produce adverse environmental consequences to one or more of those related resources that I previously described. A solution to the issue of ignoring commodity resource information is better planning through improved information. A solution to the issue of ignoring other potential resources related to the extraction of a commodity is improved education of the mining operators to recognize the need for recognition and mitigation of adverse impacts on those resources.

Timothy S. Hayes:

Thank you. The five panels provided a combination of both issue identification and some recommendations or options.

DISCUSSION OF ISSUES AND OPTIONS

Timothy S. Hayes:

What I intend to do now is try to return to things which are recognizable issues and try to determine if this Workshop can come to a consensus on listing one or more options on the addressing of that issue.

THE NEED FOR MAPPING

Timothy S. Hayes:

Lyn Bourne started with identification of issues. The first issue that was identifiable is the need for mapping. And I want someone, if they would, please, to comment on whether this meeting should say, "We should do this about the need for mapping." I think it was pretty well accepted all along that we should support, for instance, the National Geographic Mapping Act.

Anthony M. Bauer:

I would like to suggest that State resources mapping efforts be influenced by critical areas of need, in terms of urban land-use pressure and in terms of the marketplace. In other words, the mapping agencies should identify the combination of market and resource location in areas where there currently are high concentrations of people.

Timothy S. Hayes:

Is there discussion on that? First off, is there a really full consensus that this Workshop should support a National Geologic Mapping Act? Does anybody disagree? [Editors' Note: There was no disagreement.] Now, let's talk a little bit about Tony Bauer's suggestion.

Dr. Charles J. Mankin:

I think that's an excellent suggestion. It's a suggestion that the two committees, one from the Association of American State Geologists and the other of members of the Geologic Division of the USGS, recognized early on. I don't think anyone, either from the State or the Federal level, had the view that we would start at one corner of the State or one corner of the country and systematically march across the country mapping each quadrangle in turn. Rather, we recognized that, because this is going to be a process that will take years to complete, there are areas within each State, indeed, areas throughout the United States, that ought to have priority consideration. These areas include those things that we're dealing with here today, such as the identification of resources and in other parts of the country also include such

areas as natural hazards that need more detailed delineation for purposes of mitigation. Every State has planned to have an advisory committee that would contribute to the development of priorities for each State and the State mapping program, as a part of our process, part of the implementation plan. The Federal government would have a group of Federal agencies that would contribute to the planning effort at the Federal level, as a part of its effort. So there would be a State contribution to the priorities within individual States, for the State mapping effort, on a matching funds basis, and the Federal mapping effort would be driven by national needs, to recognize critical national priorities.

We treat the most critical areas first, and go down this priority list, and eventually, when all else is through, we'll map Black Mesa in the Panhandle of Oklahoma!

J. James Eidel:

I would like to point out, Tony, that that process is already in progress in Illinois. The Illinois State Geological Survey formed an Illinois Mapping Advisory Committee. Every interested or involved State agency and every industry is represented on that committee. George Dirkes represents the aggregate producers in Illinois on that committee. We have submitted a report to the Senate in Illinois on the status of geologic mapping. There are priorities involving resources and environmental requirements, including industrial minerals. Brud Leighton's talk, yesterday, on resource evaluation illustrated the priorities including industrial minerals, including requirements imposed by urban corridors.

The point is, a forum has been established in Illinois to accept industrial mineral producers' points of view for inclusion in the priorities. If those urban corridors are supported by some other mapping requirements, there is additional support for mapping corridors first.

During the committee deliberation, Al Bush mentioned the bias of mapping. The process of determining priorities from a spectrum of the community's requirements, including all agencies and industries, is a way to get rid of some of that bias. You look at why you need those maps and then you find the mappers that are going to provide the information from a broad spectrum of views, not just from a single mapper's particular view. Bias is overcome in this fashion.

Alfred L. Bush:

The bias I meant to indicate is in fact a point of strength, it is not a personal bias, one that says, "I don't want to map sand and gravel, I want to map gold deposits." It's a bias that's built in by the intent of the mapping at the time. Where did the funds come from? When I was mapping the Western San Juan Mountains in Colorado, the reason I was there was to look for uranium-vanadium deposits. I expanded it because of my own interests in mapping the mountains to see what kind of intrusive rocks were there, etc., etc., but the

focus always was clearly on the uranium-vanadium. I must say that I didn't look at sand and gravel in the San Juans as any kind of particularly important feature. I lumped them all as colluvium, alluvium, or something like that. That's the kind of bias I mean. It's not an intentional disregard, rather a setting of priorities.

On the other hand, I would mention this. There will be areas in the United States where you can map in the traditional way, using geologic contacts, formational contacts—and that's great for certain objectives. But if you are after a particular kind of sandstone, or sandstones that are useful in the area, you forget formational boundaries [or they become somewhat secondary] and you start to use units that say, "In this area, this rock sequence has 80 percent useful sandstone. That kind of grouping is appropriate to my objective." That's the kind of bias that I meant, and that's what I also meant by saying there is no such thing as a single, all-purpose geologic map.

J. James Eidel:

I believe I understand the situation. Let me add one comment about how we are trying to overcome the bias you refer to. Hydrogeologists are beginning to talk about a whole new stratigraphy, hydrostratigraphy. If a geological survey, whether it be a State or the Federal survey, can make the individual mapper aware of a broad spectra of mapping needs or priorities—even new concepts such as hydrostratigraphic units can be mapped. A mapper, whoever he or she may be, can acquire the broadest information. It becomes a matter of education of the mappers in order to acquire comprehensive information. There is a new effort to acquire information of what was mapped previously as Quaternary alluvium in a form that can be usable in determining not only whether it may include sand and gravel in it, but other units that have environmental impact. The bias issue is being addressed.

Timothy S. Hayes:

I thought that Al's comment allowed the possibility of a recommendation that might say something to the effect that "the geologic mapping should emphasize economic units." In that way, it would serve the purpose of recognizing the need for the data, and it might then contribute to providing that data.

Are there people who would disagree and oppose seeing something like that come out as a recommendation?

Aldo Barsotti:

My concern there is that economics can be very dynamic and you're into a fixed product. And this is one of the biggest problems we have with mapping, economic factors.

Timothy S. Hayes:

Can we say “economically interesting unit”?

Aldo Barsotti:

You have controversy as to what is a resource or what is simply a rock, and that has a long time element in it. We’re talking about what’s economic today may not be economic tomorrow, and vice versa.

If you’re going to do it, I would suggest strongly that you perform a rigorous exercise to clarify and standardize the word and how you interpret it. Otherwise I think you’re asking for a lot of problems.

James W. Baxter, Industrial Minerals Geologist, Illinois State Geological Survey, Champaign, Illinois:

I want to point out that we have talked many times here about the use of GIS systems. Through the use of multi-layers in a GIS system, we can combine the information that we have on a standard geologic map with any number of different parameters within formations or even crossing boundaries between different formations. So, through use of GIS, we get around some of these things. Jim Eidel has pointed out that we can plot things like chemical properties and physical properties and use them in the GIS system to get the information that is needed.

Timothy S. Hayes:

I think that maybe that comment addresses what I said; a GIS system can include the factors that influence economic value, value that will change over time.

H. Lyn Bourne:

I guess what I would add to sum up the mapping issue is to go along with Jim Eidel’s suggestion that there be a map advisory committee. We know that Illinois has done it, and Ira Satterfield suggested earlier that Missouri does it. I suspect that if somebody’s going to spend the money and go to the trouble to establish a geologic mapping program, then, indeed, they will want some kind of advisory committee, so that there will be a base map that’s going to be useful and provide the most information. Rather than try to pigeon-hole something by today’s standards, I think we should just recommend geologic mapping with a map advisory committee.

Timothy S. Hayes:

Support for the National Geologic Mapping Act and for State Mapping Advisory Committees?

Ira R. Satterfield:

I think we would oppose the economic aspect of it, because I think you’re opening a real can of worms, because

identifying recent geologic hazards may have much more impact than some other needs. I think we would oppose singling out just one area.

James M. McNeal, Office of Mineral Resources, U.S. Geological Survey, Reston, Virginia:

I want to point out that there is on the board, on the docket, a mechanism for getting input into prioritizing geologic mapping under the NGM (National Geologic Mapping) program, that’s the A-16 process. A-16 is an OMB (Office of Management and Budget) Circular; however, it was just recently revised and in that we solicit mapping requirements from the user community, wherever they may be, prioritize them, see where the majority of demands lie, and complete maps accordingly. So that’s on the docket.

Dr. Charles M. Mankin:

Can I just ask a question on that issue? I know A-16 historically, in the National Mapping program, was only topographic mapping. I know it now includes geologic mapping as well as soils and other kinds of things ...

James M. McNeal:

It includes geochemical and geophysical mapping.

Dr. Charles J. Mankin:

... developing mechanisms for soliciting that kind of requests for information. The National Mapping program does that annually, but has the Geologic Division come up with a mechanism for soliciting information?

James M. McNeal:

Actually, the A-16 exists; we’re in the process of extending to the user communities the knowledge that the A-16 process exists to get requirements in. So, we’re at the very beginning of the opportunity to do that.

Dr. Charles M. Mankin:

You’ll be developing ...

James M. McNeal:

Exactly, yes, we are developing the mechanism for soliciting information.

Dr. Subhash B. Bhagwat:

I would like to come back to the economic aspect that was mentioned earlier. I agree that it could open up a tremendously big area of influence when you talk about

economics, but it does so especially if we look at geologic hazards. That would have a potentially even larger economic impact than resources, per se. Resources we can import, but geologic hazards come from our own underground activities and geologic situation; the measures that we take to mitigate them have potential economic benefits that are so tremendous that we shouldn't forget that aspect. True, bringing geologic hazards in as an additional argument here can open up a field to work with, but I would like to emphasize that has a tremendous economic side to it in itself.

THE NEED FOR DATA BASE SYSTEMS

Timothy S. Hayes:

The next thing that Lyn Bourne's panel identified as an issue was the need for data base systems, suggesting that they be at the State level. I don't think there's going to be much controversy in saying that the meeting here would support data base systems giving the kinds of resource information that Lyn Bourne's panel listed and recommending GIS systems. Bob Joice's panel reiterated a support of geologic education and Geographic Information Systems approaches and specifically stated that the Geographic Information Systems approach should be used in comprehensive plans. I don't think there are negatives to that statement. [Editors' Note: There was no disagreement.]

THE NEED FOR PUBLIC AWARENESS OF THE IMPORTANCE OF INDUSTRIAL MINERALS

Timothy S. Hayes:

Similarly, on the third issue—a need for public awareness. I don't think there is going to be any controversy on that. Can someone frame that as an option or a recommendation? In the summary of the Joice panel, among "suggested improvements," he pointed out that "There should be better education of citizens and planners and overall better public awareness regarding geology" and "This is perhaps a two-way street, where geologists should learn more about planning and get involved in that planning."

Haydn H. Murray:

I want to say that educating is something that all of us in the industrial minerals field should be doing every day. We should go out of our way to speak to service clubs, to schools, to make them aware of the importance of industrial minerals. Most people, I would estimate 99 percent of the public, do not realize that practically everything they touch and use every day has an industrial mineral component. I like to point out that in all of the industrialized countries of the world, the value of industrial minerals far surpasses the value of metallic minerals. If you look at the standard of

living of the various countries of the world, those that have the highest standards of living have industrial minerals that are available and affordable. We who are associated with industrial minerals must be ambassadors who can carry our message to the general public.

J. James Eidel:

We've touched on a broad spectrum of public awareness issues and ways to do it. We talked about publications that could be transmitted, and Haydn just talked about a personal touch that's required to get it across. Maybe, we could look at the number of suggestions we've had through all our panels and divide them into two categories: one, the items that we've talked about producing, that people could use to get the point across, and number two, the methods that we've talked about, to get the point across. People have talked about Lions Clubs and schoolrooms and now Haydn talks about how we do it. But if we separate this issue into two items, one, what needs to be published for use, and two, how we're going to use it, then maybe we can divide it into two issues that, one, requires dollars for publishing, and, two, requires definition of the method to solve the problem by using that information.

Timothy S. Hayes:

That seems to be a suggestion for a recommendation that education appear in all the options that we're going to recommend, in just about every list. Greater education is needed, and that is a suggestion that we first recommend that every opportunity be taken for involving ourselves, the industry involving itself, in education as to the needs for industrial minerals and the roles of those minerals in society. We should then come forward with a couple of recommendations, one on publication, saying we would like to publish these kinds of materials or see these kinds of materials published, the second saying that we should construct a list of ways to effectively use the information.

William V. Bush:

The educational process statement might be rephrased from "public awareness" to "establishing our credibility" with the public about industrial minerals. The public is already aware. We can provide all the technical data, the geologic maps and the derivative maps, but without credibility the public will not have confidence in the information we're providing, and it will go unused in the planning process. It will also give the public a better understanding of the importance of industrial minerals.

Timothy S. Hayes:

I find that pretty uncontroversial, and so I've added that the industry should work to establish greater credibility.

Dr. Charles J. Mankin:

I would suggest that rather than focus entirely on industry, I think this is a problem for all of us. I think industry, State and Federal agencies, all of us recognize the important role that industrial minerals play in society, and because of their importance, all of us have a stake in it. I would urge that we broaden that from industry, to industry, State and Federal agencies, and other interested groups.

Timothy S. Hayes:

No problem. Going back to the question. Should we write ourselves a list of things that need to be published, to aid in education? I don't think anybody's willing to try it right now, Jim.

J. James Eidel:

It's in all of our discussions. It's already reported. Those things will fall out.

[Unidentified speaker from floor]:

I would say the only difference is each one of these things might be focused on different audiences.

James M. McNeal:

As you said, the education issue has hit every one of the panels. But my perception, each of those different panels, to greater or lesser degrees, are addressing different audiences for education. And so when we're talking about education, I think we need to take a look at who the audience is, who we're trying to reach, and what would be appropriate for them. I wouldn't want to give a kindergartner or a first grader the same information I want to give a public planner. The point is, we need to make sure we have targeted the audience properly and get the appropriate information to them.

Timothy S. Hayes:

We'll return to education when we get to other panels and I'd like to push ahead and do that.

THE NEED FOR MUTUAL SHARING OF INFORMATION

Timothy S. Hayes:

The next issue is one of the more interesting ones to discuss while there are still a lot of folks here. Bob Joice's point goes to the sharing of information and cooperation. He says, "The entire planning process is composed of people, those living near a site, those making decisions, and those of

similar interests. The stone industry must work with the interested persons openly to reach common goals." He recognized a need for truth and full disclosure by industry operators when dealing with planning agencies. That's an issue and a recommendation. It's a recognition that cooperation is needed, but as it is worded, it's kind of hard on the stone industry. Anybody who would not support that?

J. Kurt von Achen:

It's still part of sharing information.

Joseph P. McGuire:

As I indicated this morning, I worked in several States, and I don't know if I like that. It insinuates that mine operators are not honest people, and I don't appreciate that. I guess if we're going to do that, let's carry the step further and put the planners in the same category and say that they ought to be honest in return. I have experienced some of that the other way, too. So, I would like to see something to qualify that or just eliminate it. I don't believe all operators are dishonest, and that's what that implies.

J. James Eidel:

You might call it "full disclosure" and "full consideration of what is disclosed." That puts the weight of determining validity on both sides. "By all parties," Charlie [Mankin] says.

H. Lyn Bourne:

I would just underline that, because the implication is that no operator is credible. There are some bad people out there, but a publication from a Workshop like this, with a statement like that, implies that there are no honorable operators and that's not true.

Aldo Barsotti:

I suggest you eliminate the word "disclosure." It has a negative connotation. Put "sharing" instead. "Full sharing of information by all."

Timothy S. Hayes:

As long as I don't hear people saying, "No, don't use it," I'm going to go ahead and use it.

Right now, what I'm going to use is we're basically bringing a recommendation for "truth and full sharing of information by all parties in the planning process."

THE NEED TO ADAPT TO URBAN SPRAWL AND THE QUESTION OF POST-MINING RECLAMATION

Timothy S. Hayes:

Next, Bob Joice wrote that a recognizable issue is that zoning and planning have limited capabilities for influencing proper on-going operation of a mine. I'm not sure if it's an issue. There are plenty of regulators. Is it an issue?

A third thing that Bob wrote constitutes a recommendation, an option. He noted that one overall objective of proper urban planning, related to the preservation of mineral resources and the compatibility of the uses adjacent to quarries, is control of urban sprawl, with such techniques as service area boundaries and limitation provisions on growth-inducing facilities.

J. Kurt von Achen:

I think there needs to be some work on that. First of all, after 2 days you've convinced me. Industrial minerals are important and we need to map them. Let's assume that's done. Let's assume that around my little town there are two quarries that have 10–15 years of production left, and we have also identified a good deposit of limestone that sits underneath George and Mary Abel's farm. And that we have tried to limit urban sprawl, but George and Mary Abel are 70 years old, third generation on this farm. They're done. They sell their property to a developer, contingent upon their getting zoning for a residential development. And they come to our poor old planning commission and they need to do it, because they need to sell their land. We've got plenty of reserves so no producer wants to buy that land and hold it for the next 15 to 20 years. How do we tell them "no"? We can't tell them "no." We can't just plain take their property rights away, so there need to be some new mechanisms or legislation, and that's where you guys are going to have to do something to help, to allow us somehow to get that land into the public domain, if we, in fact, must hold on to it for the minerals underneath it.

The next thing you've got to figure out is how, when the time comes, you justly award those minerals to some producer.

Dr. Charles J. Mankin:

I don't disagree with that view. I think it's an issue that everybody has to wrestle with, and I don't think we can propose that we set up a rigorous plan that said that here's a tract of land that will be held in perpetuity until such time as these minerals have a potential for use.

I think the important thing that needs to be done in the planning process at all levels is to recognize that mineral resources are one of several issues that need to be addressed. Up until now I have seen little evidence, at least in our State, that any planning activity at any level gives any consideration whatsoever to commodities or to mineral resources as

a part of the planning process. It doesn't mean that you set an area aside for mineral development, just as you won't set an area aside in advance for housing development until someone comes in and comes before you and says, "I want this area zoned for housing." Generally, that's the first time you really give that serious consideration.

So all we're asking is that at that time, you look at competing land uses to the extent it is possible, you recognize the value of sequential land use, and you take into consideration, in this process, that minerals play a role that should be given consideration.

Timothy S. Hayes:

At this point, I am trying to modify what Bob Joice wrote, to give myself some headstart down the road. I'm not sure, Kurt, were you actually suggesting that something be recommended or listed as an option?

J. Kurt von Achen:

Well, I guess my comments were different. I thought it was more imperative to maintain some of these sites. You've got to recognize that when you come in down the road, you're going to have a tough time because of what has developed. And so, if we need to save the mineral sites, somehow, once they are mapped, then you folks have to help us get some mechanism by which we can do that. I guess what I was trying to say was maybe there should be some study or recommendation or some effort out of this group to consider the point of how do we, as the public, maintain or preserve the minerals. And, I don't know how to do it.

J. James Eidel:

We're at a very interesting point in this discussion. I think Charlie [Mankin] is right in saying that perhaps the recommendation that should come from this group is that we want it to be assured that county planners will take industrial minerals into their planning process. The next step that Kurt is referring to may be a legal step, an individual State issue in determining what legislation may be required in an area of severe urban sprawl that needs industrial minerals. Maybe now we're at a point where we need to look at that issue State-by-State. Maybe the collective recommendation would be for the States to take off from this point, and address whether there are individual areas where legislation needs to be considered.

J. James Eidel: Comment after session: "Planners, however, should be aware of location and quantity of resources available, and should consider them."

Timothy S. Hayes:

That leads into another point. It's obvious that rock quarries are very long term activities and reclamation plans

for later use are difficult to envision, but such plans are critical. Communities want to know what will happen after quarry closure and obviously they want good things to happen. That's an issue. Is there a recommendation that should specifically address that?

Anthony M. Bauer:

I would like to raise some reservations about the idea of identifying end uses as part of the reclamation plan. There is no one in this room who can predict land-use patterns that are going to occur in 25 to 50 years. I think it is more important that language related to land-use planning consider things like "building usable land, stable land, reproductive land, and accessible land," rather than require definition of specific land uses. There was a suggestion earlier that the designer indicate appropriate concepts of land use. In my opinion, that would be somewhat acceptable, but oftentimes you get into debates about that end land use rather than debates about the mining and reclamation process itself. I don't think it is relevant or productive to worry about a land use 50 years down the road. I think it's more important to build a productive environment or a usable site.

J. Kurt von Achen:

I totally concur. We can't predict it. Don't show land use. I think it would be useful to worry about how it drains, how stable it is. Get it reclaimed into some usable form, but I don't propose showing specific land-use development.

Timothy S. Hayes:

Okay. The question that I ask is should something be written in the list of options on what to do about the question of post-mining reclamation uses? We say that reclamation plans are essential and there probably can't be too much disagreement with that. Is there something that should be written or recommended about taking specific action? Is that something that should be listed as an issue? Just that there is a need for post-mining reclamation plans, but without a recommendation or option?

Dr. Charles J. Mankin:

It seems to me that one of the things that would be valuable in this process would be to recognize that mining is a temporary use of the land. In fact, I think we should have a statement that mining represents a temporary use of the land, and that mining and reclamation plans should recognize the concept of sequential land use. And, leave it at that.

Timothy S. Hayes:

Now Bob Joice had written that an overall objective of urban planning is the control of urban sprawl with such

techniques as urban service area boundaries and the limitation provisions on growth-inducing facilities. These are directly related to preservation of mining resources and the compatibility of uses adjacent to quarries. We had gotten into the question of whether we should say that States should look toward the possibility of legislation. And you wrote as a recommendation, that land planners should include the need for industrial minerals in all planning considerations, then went on to say, in those areas where options by a planning commission to preserve access are limited, local and (or) State governments should consider legislation to preserve access to industrial minerals for the purpose of maintaining adequate quantities of industrial minerals at a reasonable price. Okay. All of that is partly substituted for what Bob Joice had written in rough form.

J. James Eidel:

I don't think we fully addressed what he said about the boundaries. Boundaries are a concept that is entirely new to me. Could the planners comment? I don't think we've addressed that issue.

Timothy S. Hayes:

I think Jim's right. Bob Joice's statement here is fairly specific. It recommends that land-use planning adopt specific courses. Is that right, Kurt?

J. Kurt von Achen:

It seems to, and that's my problem. I don't think we have the legal authority to do that kind of thing right now. I think it's going to take some State legislation to enable us to preserve that. You just can't take away people's property rights. That's what you're asking to do. There has to be a line drawn someplace. When you want to tell a man he can't use his property for anything, because you want to preserve it for the next 25 years so that you can get the minerals out, you have problems.

Timothy S. Hayes:

Can it be written that States, individual States, should individually explore the possibility of legislative or regulatory consideration of recognized industrial mineral resources and that this meeting recommends the recognition of sequential land use?

THE NEED TO ADDRESS IMPACT ON TRANSPORTATION AND THE ENVIRONMENT

Timothy S. Hayes:

Next we come to the fourth issue raised by Bob Joice's panel, which says that as with most petitioners seeking local

approval for specific land-use activities, quarry operators must recognize potential negative impacts and propose appropriate ways to mitigate them. The primary items to address are transportation impacts and environmental impacts, particularly on adjacent or nearby lands. That would, again, constitute something that would go in a list of options or recommendations.

Is it something that needs a lot more discussion, and is it something that should be in the list of options and recommendations?

I don't see any particular trouble with it. I particularly look to the producers, now.

Haydn H. Murray:

Would that come as a part of "full sharing"? [Editors' Note: This refers to the preceding discussion on the need for the mutual sharing of information.]

Timothy S. Hayes:

It might well go under that.

Dr. Charles J. Mankin:

That's somewhat like our panel's comment on the issue of other resources, as well.

Timothy S. Hayes:

I don't think we're going to be able to take it all apart, because it all is interconnected. I think we're going to come back to the question of how do we say that the full sharing of the information is needed?

THE NEED TO BE ENVIRONMENTALLY RESPONSIBLE

Timothy S. Hayes:

I want to go on now with an attempt to refine some of the recognizable issues and options. I sat down with John Kiefer just a minute ago and took apart in that way what he had written earlier, and I'll start into it now with the subject of environmentally responsible production.

The first issue is, "The concept of environmentally responsible mineral extraction is largely a matter of perception, and perception is largely a function of perspective. There are industry perceptions, regulatory perceptions, political perceptions, planning perceptions, environmental perceptions, and the perceptions of the general public. In addressing that as an option, the only way to reconcile the difference in perspective is through communication, good public relations, education, and cooperation among all

parties concerned. Failure to do so will impact us all, but will have the most direct and obvious impact on the industry. Therefore, it is imperative that industry take the leadership role. The cost of doing so is far less than the cost of inaction—act, don't wait for things to happen and then react."

Is there anything that the people from industry would like to see changed about what that says? [Editors' Note: There were no comments.]

Second issue, "Environmental responsibility goes far beyond just meeting permit-regulation obligations. We cannot just say that we are part of the community, we must show that we are part of it by our actions." The option is, "Industry needs to play a part in the drafting of regulations and a leading role in working with and educating those enforcing the regulations."

Third issue, "Poorly paid and poorly trained permit writers, regulators, and inspectors seem to be a universal problem and one that won't soon be resolved." The option, "The best policy is to meet the situation head-on by working with inspectors and regulatory authorities to make sure they get the proper training and are aware of the problems and constraints under which the industry operates. Such steps as informative quarry tours and informational pamphlets, slides, and video and well-designed training manuals and short courses can help."

Let's go on to another issue. "One area regulated by EPA, which will have a major impact on mines and quarries, is a new storm water discharge requirement. This could pose a heavy burden on the industry."

James J. Murray:

Well, yes, that's a true statement, but that also applies to a lot of other businesses than just quarries. You look at any regulation, and it ends up costing business or industry money.

Timothy S. Hayes:

What is the answer to that?

James J. Murray:

That's what I was just going to ask.

Timothy J. Hayes:

Is that something, first off, that wants some discussion?

John D. Kiefer:

I mentioned that because it was one of the issues raised by a panel member. Obviously storm water discharge is going to be a major problem for quarries and mines, but many don't realize the full impact of that requirement. I'm

wondering if perhaps by posing it as an issue, trade associations will look into it to find out what the true impact will be and maybe to frame the manner in which industry is going to have to respond. As a small producer this may not impact you as much. Martin Marietta probably has personnel that handle the issue internally, but there are lots of other small quarries, small operators out there, that need help and that don't know how to deal with these regulations and permits, and they need some guidelines to go by. That's basically what I'm suggesting. It is an issue, and somehow it needs to be dealt with for the industry in general.

James J. Murray:

I agree with that. Unfortunately a lot of the smaller operators don't even belong to any associations or trade organizations. It's tough to get those quarry operators into the fold, as it were, but that's a true statement. I think that's something that probably needs to get out to the industry as a whole.

Timothy S. Hayes:

Can that be listed as an option, that this Workshop would try to make a general effort at getting information out through the trade associations?

James J. Murray:

I would think so.

THE PROBLEM OF REGULATION

Timothy S. Hayes:

This next thing is something that doesn't really have an issue attached, but is a recommendation or an option. It says most of the regulatory responsibility for such as NPDES, blasting, and reclamation lies with the States. The final comment from the Joice panel is, "The primary influence of State and local government on industrial minerals appears to be regulatory. As is common in other planning areas, such as agricultural resources or historic resources, those involved in planning should be encouraged and assisted to view mineral resources as worthy of protection and preservation." This puts the regulation at a more local level, which is as it should be, because the environment and conditions in each State are different. In fact, we need to realize that each quarry is different and there should be some flexibility in the application of regulations. That statement is a recommendation. Unless somebody has a problem with it, it's going to be listed as such.

John D. Kiefer:

I guess the option goes back to that education issue again, but the suggestion or recommendation is that the

regulatory agencies need to be more flexible in their application of the regulations.

ENVIRONMENTAL COSTS OF IGNORING INFORMATION

Timothy S. Hayes:

At this point, we are now through to the panel on environmental costs of ignoring resource information. The summary by Dr. Mankin framed the issues and options pretty well. Should I read it again, or can people remember it, and we can move ahead? The panel identified two kinds of issues relating to the environmental cost of ignoring resource information. The first is ignoring resource information relating to the commodity to be mined, e.g., sand and gravel, limestone/gypsum, etc. The second is the array of other resources that may be affected by the extraction of an industrial minerals resource. That list of other resources includes soils, surface and ground water, wildlife endangered species, cultural, vistas, fossils, archeological, and air. If commodity resource information is ignored, the planning process can lead to land-use practices that prevent access to those other resources. This can lead to the development of those commodities elsewhere and at greater environmental costs, and they cite the Denver example. Ignoring the existence of resources that can be affected by mining can produce adverse environmental consequences to one or more of the related resources. A solution to the issue of ignoring commodity resource information is better planning through improved information. A solution to the issue of ignoring other potential resources related to the extraction of a commodity is improved education of mining operators to recognize the need for recognition and mitigation of adverse impacts on these resources.

THE NEED FOR RESEARCH AND DEVELOPMENT

Timothy S. Hayes:

We'll go on, then, to cost factors. I'm going to be listing issues, with a few later that are not exactly issues. For the first one, the panel concludes that cost increases with insufficient price increases have squeezed profits over the last few decades, and the result is a lack of money for research and development. The next question is, is there something that should be listed an option to try to address that? Doesn't seem so.

The second issue is that there is an inability or unwillingness on the part of aggregate producers to engage in public relations and to inform the public about their genuine economic problems. The question again, then, is there something that can be recommended to address that issue?

Dr. Subhash B. Bhagwat:

George Dirkes made a suggestion on this point, and I think it falls in the area of education or information. If we have included something in the area that producers ought to make contacts with the public as well as with government agencies at all levels, then this item will be included in that statement.

As far as the first point with regard to the inadequacy of funds, there is a point down on the list where one of the members of this audience suggested that the check-off system should be investigated as a possibility of raising funds. It is like the corn producers who pay a certain amount, a penny or two a bushel, into an account and then use that amount of money to do all kinds of things, including some research funding. A similar system could pay some unspecified amount into an account and then that accumulated total can be disbursed for research as well as for other activities that would benefit the industry and serve both the purposes of cost reduction as well as information dissemination.

It was recommended because, if applied to all producers, it doesn't give anybody a cost disadvantage. The amount should be so low that it shouldn't make an impact on total cost.

Timothy S. Hayes:

That brings a quick return to the point. One, the issue was a lack of money for research and development. And the question is, should we list as an option in addressing this check-off system, an income tax check-off system?

Dr. Subhash B. Bhagwat:

No, it's not an income tax. Check-off is a system where a penny or two per ton, maybe, are diverted into a fund that is controlled by the industry with regard to disbursement, and that money can be used then for research. It's not something that goes into a government account. It is a separate thing that stays under major control by the producers.

Timothy S. Hayes:

The producers, then, should look into establishing a check-off system?

Dr. Subhash B. Bhagwat:

Yes.

J. James Eidel:

This is one way to raise money. There are others. A number of you are aware that the National Stone Association and the National Aggregate Association currently are

creating a foundation to provide money for research, for a national center on industrial minerals, and a number of States or universities have been applying or are expected to apply for that.

There is fairly broad recognition in this country that the independent producers are not able to conduct research at the scale of their operations and that maybe there should be efforts made to raise money to provide research on their behalf. There is a great deal of research going into oil and gas now on behalf of the independent operator.

I would suggest that we provide a recommendation that calls for looking into the raising of funds for industrial mineral research and development, in general, and that we explore the ways and use the mechanism that Subhash just mentioned as an example of how it may be raised.

Timothy S. Hayes:

Jim's suggestion is to broaden the possible recommendation from this Workshop to merely suggest that options should be investigated for raising research and development money with the specific purpose of researching for the industrial minerals.

Ira R. Satterfield:

I would like to add for consideration a mineral check-off list. Dollars could be used in part for R & D, but mostly for education, just as it is in agriculture on beef, pork, corn, and soybeans. That check-off was basically to aid marketing. Yes, a lot of dollars did go into the research part of R & D, but the main thing was to get the public aware that there was "another white meat" out there besides chicken, pork. That's what the check-off was designed to do. You have to spend to inform the public about industrial minerals. If the people don't get informed, no change is going to happen.

Dr. Subhash B. Bhagwat:

I agree fully with what you are saying. It's true, corn boards are using the money. They are called corn-marketing boards in most States. The reason it came up in our panel here was the statement by aggregate producers that costs are rising and something needs to be done to rationalize and to lower the cost of production, because prices are not rising. So, the main thrust in this particular case was how to get those costs down, and that's why this point came up. But, true, there are a lot of items that will need the money, and this should be considered.

Timothy S. Hayes:

It sounds like agreement with what I wrote, saying that in addition to mentioning the check-off system for R & D,

check-off funds could also be used as a possible source of funds for education efforts.

Virgil W. Smith, Jr.:

I suspect that local material producers are not going to sit still for a levy against their tonnage to support research and development. I suspect Martin Marietta will not sit still for it. I know that Dolese in Oklahoma has been offered opportunities over and over again to join a State organization to support the production of stone and sand throughout the State of Oklahoma, and in my 37 years, they have steadfastly refused to join any such organization. It's strictly a matter of competition. We're meddling now into a competitive field, because the big boys that I've addressed are not going to give money so they can help the little boys compete with them. That's what you're asking for and they are not going to do it. [Editors' Note: The financial suggestion by Jim Eidel was for a general funding, not a levy on operators.]

William V. Bush:

I think this is an area where government should not get involved. Industry has done a very good job in research and development of their products. I don't know if they want government involved in marketing, research, and development.

Timothy S. Hayes:

In what Subhash said, there wasn't a suggestion that government become involved; that suggestion was perhaps implied by Jim Eidel. There was the suggestion that opportunities for research and development funding should be investigated and then, specifically regarding a check-off system, that the producers themselves should consider establishing a check-off system. Is that still not acceptable?

James F. Murray, Martin Marietta, Savannah, Missouri:

Regarding Virgil Smith's comment about the larger producers getting into a check-off type of system, we've been involved in a few things like that and that would be very, very tough to do for any producer regardless of size. Also, I think Jim Eidel made mention of the National Aggregates Research Foundation. The NSA (National Stone Association) has raised close to \$4,000,000 for an on-going research program on aggregates, and that is one big step. I think that any other recommendations about a check-off system or some type of funding will fall on deaf ears. I don't think that would be part of the scope of this group.

J. James Eidel:

There may be a way to resolve it without dropping it. What George Dirkes was referring to, in terms of what

needed to be done, was derived from a meeting between the Illinois Department of Transportation, Southern Illinois University, the Illinois State Geological Survey, and the Illinois Association of Aggregate Producers. We sat down and looked at what was needed from the producers' point of view, from the Illinois Department of Transportation's point of view, and came up with a list of research topics that Brud Leighton mentioned in his talk.

Maybe we're back to looking at this as a State issue, because we won't resolve the larger companies/smaller company point of view. We have exactly the same major company/smaller company situation that exists in the oil and gas industry. Maybe a compromise would be to come again to the individual State point of view. Explore the need for R & D from the State point of view instead of from a much broader point of view.

Timothy S. Hayes:

I'm a little uncomfortable. It's obvious from the two producers that this is something they feel is not in the scope of the meeting, at least on the regional basis. I wonder if that isn't a pretty conclusive statement, if it isn't in the scope of the meeting in their view, then it, as they are part of the meeting, is not in the scope of the meeting. What I'm inclined to do is strike both the suggestion of a check-off system and the first issue, that cost increases with insufficient price increases have squeezed profits, and the result is a lack of money for research and development. Does that follow?

James F. Murray:

I think we might just make a statement that there is a need for research development and forget about anything else. Just have that as a statement.

Timothy S. Hayes:

Okay.

Virgil W. Smith, Jr.:

What has squeezed the profit level is competition, pure and simple. You've got three quarries side by side, and they're fighting one another. And I don't fabricate examples, I'm talking about a real example. They're chopping one another up, and they're not going to put money in the pot to help each other.

J. James Eidel:

Let me make one last comment on this subject. The five Illinois operators that were represented here have left. George Dirkes was representing those operators. They are relatively small operators that have mineral resources in a

quarry or two. I'm not sure that the small operator wouldn't wish some research to be done that helps the Department of Transportation in his State to accept his product. One of the problems is what to do with the fines. Maybe we need some generic way to market fines. I don't think we should stop thinking about the small operator who has no opportunity to do any research at all and needs information to maintain his market.

THE INDUSTRY'S ECONOMIC PROBLEMS

Timothy S. Hayes:

An issue listed by the panel on costs is, "There is an inability or unwillingness on the part of the aggregate producers to engage in public relations and inform the public about their genuine economic problems."

First off, is that an accurate representation?

James F. Murray:

I don't think that's a fair representation, to be quite honest. Just about all of the large companies have some type of PR programs and quite a few of the smaller companies have them locally as well. I don't think that's really a true representation of most of the companies in the aggregate industry. Also, you had a statement in there about the general economic condition. Is that right?

Timothy S. Hayes:

No. It actually was, "There is an inability or unwillingness to inform the public about the industry's general economic problems."

James F. Murray:

Well, that falls on every business concern. Everybody has economic problems. General, is that what you said?

Timothy S. Hayes:

That's what it said.

James F. Murray:

Well, that's a pretty broad spectrum applicable to anybody that has money invested. So I don't know if that's applicable.

Timothy S. Hayes:

What that was pointing to was the statement that industrial minerals producers should expend more effort in education. Is this true?

James F. Murray:

I'd agree with that.

Timothy S. Hayes:

What I was going to suggest is to simply get it reworded that way in the list of options. Is that fair? [Editors' Note: There were no negative expressions.]

The cost panel recognized another issue. "Many sub-headings of operational costs are beyond producers' control. However, the industry is not doing enough to influence public education." Again, that is probably not an objectionable issue, is it? Many of the operational costs are beyond the producers' control. [Editors' Note: There were no negative comments.]

Next statement: "Recycling of concrete and asphalt is economic and environmentally desirable. The industry should join it and take advantage of it instead of resigning to it." Is it a recommendation or option? Agreeable? I don't see disagreement so I am going to assume it's agreeable.

Next: "Production is moving farther away from consumption sites. Cost of transportation is often a multiple of the cost of production. Cheaper transportation alternatives are needed." That's both an issue and an option. Can we divide them that way? That production is moving farther from the consumption sites and the cost of transportation is a multiple of the cost of production is a fact.

Haydn H. Murray:

One of the things that was not brought out in the discussion of transportation costs is the advantage of water transportation. It is available in most of these States which have major river systems. I know for a fact that from Evansville, Indiana, to Chicago, the cost of transportation by truck is about \$22 or \$23. You can put that same material on a barge and go to Chicago for less than \$4, by going down the Ohio River to the Mississippi and then up the Illinois River. Water transportation will become more important in the future because of its low cost.

Timothy S. Hayes:

Thanks. That's easy to add to the list of options.

Cheaper transportation alternatives are needed; that was one, obviously. Are there others?

Next on the list of issues: "Higher quality specifications are reducing the available resource stock, but prices are not rising proportionately. The latter is an indication that supplies are abundant." Is that true?

Dr. Subhash B. Bhagwat:

Let me clarify the wording there. What we are talking about are specifications for the aggregate which require a

higher quality (meaning better) and better products are demanded. In the process, some of the resources, which do not meet those specifications, will be cut out of the market. And, yet, it seems prices are not rising, and one of the suggestions was that it's because of the intense competition, which means that several people are offering that quality material at the market, and that's why the prices are not rising.

If that's true, maybe the producers can take some position regarding that.

Timothy S. Hayes:

I think that would be worthwhile.

Virgil W. Smith, Jr.:

Producers may have several layers of quality in their quarries. One layer of quality called concrete aggregate. One layer in the quarry they call asphalt aggregate. They work them separately in the Tulsa area. There are many quarries in southern Oklahoma (the general range of my experience) with excellent-quality limestone, dolomite, rhyolite, etc. There are also quarries in the Viola Limestone [Upper Ordovician] that are not acceptable. There are new specifications now that require 5,000 psi (pounds per square inch) compression of concrete as opposed to the old standard of 3,500 psi. It takes a better aggregate. There is a new freeze and thaw test that you have to submit your stone to 350 cycles.

Many quarries have been disqualified in the State of Oklahoma because of the freeze-thaw test, and I'm sure that's the case nationwide. So the fellow that has a good quarry, or a good ledge in his quarry, is in a position to charge a higher price, and he is going to do that if he can. The low-quality-material quarry will be shut down or the producer's going to sell the material to a secondary market.

Timothy S. Hayes:

The question that Dr. Bhagwat then asks is, does the fact that the price is not rising indicate intense competition—what you said is consistent with that. He noted that higher specification aggregates should reduce available stocks. His question then is, does the fact that prices are not rising indicate that supplies of high-quality, high-specification aggregate are adequate?

Virgil W. Smith, Jr.:

Well, in Oklahoma, yes, in some areas, in other areas, no. I'll tell you a quick story. During World War II, officers from Fort Sill went out to the Dolese Brothers Quarry to survey available resources for the military. They went back and turned in a report in cubic miles. The Arbuckle Group [Upper Cambrian and Lower Ordovician] there is 6,000 feet

thick, and it's a long ridge, so there's no shortage of high-quality material in that particular part of the State. Jump back up to Tulsa or go over to Pryor, a fellow just sold stone there for \$5.75 a ton at a quarry for class A stone, which ordinarily sells for around \$4, because he did have a high quality and nobody else did.

Valentin V. Tepordei:

The fact that the price of aggregate did not increase too much is mostly due to automation and to high efficiency and larger equipment used by the industry. I have a graph that shows that the unit price of aggregates in constant dollars stayed almost flat for the last 20 or so years. The producers are not losing money. They are still making a relatively good profit margin, but they compensated for the increase in actual costs by automation and high-efficiency equipment.

Timothy S. Hayes:

All of this leaves me to wonder if it is a true issue, that higher quality specifications are reducing the available resource stock. If that is true, it is not an issue.

I think from here on, it's not really issues, is it? The next point is, "Underground extraction can be economically competitive under appropriate circumstances, especially when due credit can be taken for the utilization of underground space for other commercial purposes. This option should be given consideration." That's a recommendation.

We discussed the next point earlier about consideration being given to an R & D plan, and determined it probably shouldn't appear here.

Next is also a recommendation, "The aggregate industry should keep its eyes open for other substitute materials such as flyash, slag, etc., competing with its materials. Adaptation to changing demand and supply situations is crucial."

Dr. Subhash B. Bhagwat:

Louis Griesemer mentioned that new materials, as well as recycling, are becoming more important. Over a longer period of say 20 to 30 years, materials do get substituted and that is the only point that it tries to make. It is neither an issue, as far as I see, nor an urgent recommendation in that sense. It is a point of interest that was noted and we felt that it was important enough to include, that's all.

Timothy S. Hayes:

The next point could be an issue. It says that, "Increasing quantities of fines with little demand for them pose a cost factor." And it also presents a possible option, that new ways to mine, wash, and use fines are needed. I would like to hear from the industry again. Is it an issue?

James W. Baxter:

I'm not from industry, but I would like to point out that we are again identifying an area for R & D. We're going to have to say that R & D funding is a problem. However, just a few minutes ago, we backed off completely from making any sort of recommendation whatsoever for any type of funding and even from the idea of seeking new avenues for creating R & D funds. It seems to me that we could include some sort of generic statement about research funding. I think everybody would recognize that we do have the need for industrial mineral research into ways of not only meeting the problems that the individual producers have with fines but also with finding new markets and new uses for fines and of attacking other sorts of problems.

James F. Murray:

Obviously, every producer has a problem with generation of fines. That's something that's definitely not peculiar to any one operation. But that's a production problem that every plant experiences. If we want to talk about specific production problems, we could spend 2 or 3 weeks on every one, and generation of fines is just another discrete production problem. I really don't know how that fits into what we're looking at, when we're talking about mineral resources, or the protection thereof, or whatever.

Dr. Subhash B. Bhagwat:

John Schmidt on our panel brought up this issue when I was talking with him before he left. The point he was making was that, because of the mining methods or because of changes in specifications of required material, more of the mines' extracted materials are going unsold; that means that if previously 1 out of 10 tons was not sold, now it may be 2 out of 10, and the cost of that has to be borne by the 8 tons that are being sold. So, it does turn out to be a cost factor if more of your tonnage is not being sold, whatever the reason, in this case because of fines. The remedy to that would be either to take care that not so much fines are produced or that fines produced are sold in some form. We thought that was a factor affecting the cost and therefore it was included.

Timothy S. Hayes:

I'm not so sure Jim Baxter's question wasn't well taken. But, if we include a statement about fines (at least as a problem factor), would we not also include an R & D statement? The alternative is to not include a statement about fines.

Virgil W. Smith, Jr.:

The specification writers (State Highway, Corps of Engineers, etc.) control the amount of fines that are produced—it's not totally true, but they greatly influence the

amount of fines that are produced by any production process. Historically, the first time that I ever loaded a car of rock for production of concrete ready-mix in Oklahoma City, the rock had to pass a 1 5/8 in. square opening, and it had less than 10 percent passing the 3/8 in. screen. Nowadays, the specification is size number 57. They may have changed the name lately, but anyway, it is 100 percent past inch and a half, 95–100 percent past 1 inch, and 25–60 percent passing the 1/2 in. screen.

As people demand pumpability and workability of concrete, they want to get rid of the harshness created by larger particles. So, it is fairly common for people to specify size number 67 which is 100 percent past the 1 inch screen.

Last fall I was involved with an order of half-inch chips down to Texas from southwestern Oklahoma. We couldn't meet the production requirements from the high-silica quarry, so we hauled 6,000 tons of high-silica material 20 miles to a high-production limestone plant, where we processed it, and when we got through, we had 35 percent chips, and 65 percent screenings. That's my lesson to you today in crushing. That's what happens when you crush rocks. You make fines.

Timothy S. Hayes:

That perhaps is the answer, we're into a problem that we're not going to do anything about. If that is the case, I would like somebody to say that it probably doesn't belong in the summary.

Garland R. Dever, Jr., Kentucky Geological Survey, Lexington, Kentucky:

As you're talking about cost factors here, and it certainly appears that there may be a cost factor if you lose 65 percent of your stone, could you simply use fines as an example of the type of cost factors that producers are encountering on a day-to-day basis in their operations? Maybe that would solve all the problems. Just as an example, rather being a specific issue, since, as the man from Martin Marietta pointed out, he can give us 2 weeks of problems to talk about. So this would be an example that was brought out by the panel during their discussions.

Timothy S. Hayes:

I'm pretty sure that's exactly what has to happen. There won't be any kind of a listing of options, addressing some of these cost factors, but some of these examples of costs will be given.

J. James Eidel:

Let me point out a fact with respect to the National Stone Association R & D funding plan. The foundation goal is \$4,000,000. During the first year only \$40,000 is available

for research nationally. It is to be doubled the second year. The dollars available are still minuscule. The NSA plan is not going to solve any national R & D needs for some time. More money is needed.

CLOSING STATEMENT

Timothy S. Hayes:

The reason we have dragged everybody back in here is to ask for some post-meeting help on framing some kind of a recommendation about education, the subject that came up over and over again. [Editors' Note: We later received several oral and written communications that did help us find where the consensus lay, as now incorporated into the summary.] We have said a number of things in a disconnected fashion: that the industry itself should take every opportunity to communicate the need for, and role in society of, industrial minerals; that the industry and both State and local agencies should establish their credibility. "Education" recurred all through the meeting and was easily the most common thread. In our summary, we are going to close with some kind of a statement that emphasizes that point.

The other reason for returning to this late session is to describe what will happen from now forward. Our procedure from here on will be to transcribe all that we have said; then we will send transcripts to those persons who spoke in order that they can make sure that what they said was exactly what they intended to say. The next step will be editing. If statements were repeated through the course of the meeting, they may be edited to appear in a more appropriate subject area, and therefore they may appear out of the sequence that took place here at the meeting. We will probably move things to more appropriate subject positions in the Workshop, so I want people to know that their statements may appear in a different time sequence than they expected. We will take some editorial liberties to make the transitions as smooth as they can be. [Editors' Note: After reading the transcription, there seems to us to be no need to alter the sequence of statements. The transcript appears here with an absolute minimum of editing.]

There are probably going to be future industrial minerals Workshops. The next one is not scheduled, but we'll try to make sure that people hear about it. [Editors' Note: The fifth Workshop was held in Minneapolis in September 1992.]

The last thing that may deserve saying is that it's our present intent that everybody who was registered for the meeting eventually will receive a Bulletin, and everyone who has said anything at the meeting will probably be seeing a transcribed portion of what they said before that Bulletin can come out. The time frame from that to a Bulletin is approximately a year and a half. [Editors' Note: That turned out to be optimistic.]

One more thing, perhaps, is for the people at the State geological surveys. We're going to be getting together with you again to ask about appendices, and then try to use appendices, as we have stated earlier, to produce a list of "here's where the informational resources in each State are." We may also decide to consolidate a list of "this is what the permitting processes here in Oklahoma are, or this is what they are in Illinois," or something like that. So we will also be back in touch with the State Survey folks to ask for their input into an appendix of that type. [Editors' Note: See Appendices.]

With that, I'm glad to adjourn.

SUMMARY OF ISSUES, OPTIONS, AND RECOMMENDATIONS

[Editors' Note: This summation represents the consensus of the Workshop attendees, as we have interpreted that consensus. We do not suggest that there was unanimity of opinion on options and recommendations.]

The overriding focus of the Midcontinent Industrial Minerals Workshop turned out to be twofold—public awareness and education (they are slightly different facets of a single problem)—education of the public, and of government agencies at all levels, to the essential need of our civilization, of our kind of lifestyle, for industrial rocks and minerals, particularly for construction materials.

In the paragraphs that follow, most issue areas discussed at this Workshop are presented. Wherever possible, for those issues where the Workshop identified options to address an issue, the option follows directly after the issues' identification. The summary concludes with the assembled consensus recommendations.

Considerable overlap is evident in the issue areas identified by the Workshop, and to a considerable degree in the options for addressing those issues. The recommendations developed from the Workshop are not unique, they have not sprung fullblown into our view from an act of instant inspiration. They are the results of much experience, give and take of ideas, compromise, and a general conviction that there is much to be done for the welfare of our environment and the construction materials industry.

One way of categorizing the issues dealt with in the Workshop is by grouping them into those that are external to the industrial minerals industry and those that are internal—issues that exist whether or not construction materials are involved or extracted, and those that arise with or from extraction. In the first group are included resource evaluation, much of land-use planning, and some portion of the responsibility to restore and preserve our environment, an environment friendly to human and all other inhabitants. In the second group are the direct economic costs (materials, labor, transportation, power), the direct environmental costs

(pollution, preservation, reclamation, recycling) and the indirect costs of ignoring resource data (the impact on some resources and on some social problems by the extraction of another resource).

In the issue area of resource evaluation there is immediate concern for adequate mapping of sources of construction materials (and their environs) and for identification of wetlands, unstable ground (both surficial and in the subsurface), or any competing resource that may prevent use of a materials source. Resource availability is constrained by location, and so there is a pressing need for demographic data for the areas where the resources occur: where do the people live, what is that geographic environment, where are their work places, what and where are the means of transportation, communication, and power transmission? It is vital that the public become aware that the industrial mineral resources are both essential and limited in quantity and location. To meet these needs there are good options and opportunities for action that have the support of this Workshop: support for the recently passed National Geologic Mapping Act and increased or initiated use of Geographic Information Systems (GIS) methods of data acquisition, analysis, and presentation. GIS will allow many factors to be selectively isolated or combined to present data. Another opportunity is for provision for easy access to published data such as bibliographies of theses, dissertations, and the like. Critical areas of need (the confluence of people, land pressure, and market areas) must be identified and concentrated on. Priorities will have to be established to focus on resources, or hazard areas, or transportation routes, for example.

Land-use planning is an issue area that involves many problems. Demographic and resource data are essential tools for the planner. The decisions are ultimately political, but they need to be based on pertinent information, fully disclosed, and those discussions should be made after open discussion. Ideally the standard is the most beneficial use of the land; pragmatically we must deal with many contending forces. Urban sprawl is a major problem whether construction materials are impacted or not. The siting of transportation routes and access to power complicates the situation and restricts the options for alternative uses. Among options in influencing the directions in which urban growth propagates and controlling its extent are techniques such as zoning, establishment of urban service areas, and setting limits on the size of facilities that encourage unrestricted growth. Zoning is effective, however, only at the stage of initiating an activity; it has no effect on already established activities.

Although land-use planning should not attempt to define long-range usage in the light of present-day concepts, it should view the needs for reclamation in order to allow for long-term, sequential, beneficial use. That means it is necessary to get input into the decision-making process from the public, from the State and local regulatory agencies, from industrialists, economists, agronomists, geologists, from

those who live in the affected area, and from those outside the area who are affected by activities within the area.

The construction materials industry has to be particularly concerned with land-use planning. The industry's options include working closely with the planners, persuading them to view mineral resources as worthy of protection and preservation, supporting the staffing of planning departments by fully trained, broadly educated personnel, and conducting effective and cooperative efforts to inform the public about needs, plans to prevent undesirable effects, and long-range mitigation and reclamation. This is a return to the Workshop's focus on a need for public awareness and education.

Costs are an overriding issue with the industry, and there are perhaps more cost issues than options to deal with them. Rising costs unmatched by price increases squeeze profits and result in little investment for research and development. General economic problems, including some operational costs that are not in the control of the producer, can be made worse by legislative actions at both the local and the State level. A partial antidote is increased emphasis on acquainting and educating both legislative bodies and the public with the problems of the industry—this is a significant part of good public relations. Urban sprawl has contributed to increasing the distance between quarry and user, so the cost of transportation may double or triple the cost of material at the quarry. Cheaper alternative transportation methods (rail, water) might be feasible in some circumstances. Underground extraction is an option with much less surface disturbance, and it might be economically feasible for some sites, particularly where the mine-to-user distance could make for significantly lower transportation costs. Once mined, the underground space created can be turned to profitable use in warehousing, thus offsetting the greater costs of mining underground. Changing specifications for "high-quality" materials can reduce available stock and may contribute to an increased amount of "fines," which already pose a problem because of low demand—another example of rising costs. An option might be found through increased research and development into mining, washing, and usage. Recycling and substitute materials present both a problem and an opportunity for producers; the option seems to be that if you can't compete with them—join them, and benefit from past experience in supplying and handling construction materials. How to pay for research and development (a need noted in several instances above) presents a major problem. At this time support from the State or national producers associations is the only region-wide identified option to fund such research and development. A tax-supported program seems an unlikely alternative. This Workshop did not come to any consensus on who should properly conduct such R & D, nor was there any consensus on who should properly pay for it. Competition among the industrial minerals producers appears to stand in the way of possible funding options.

The very concept of environmentally responsible production depends on the position from which the issue area is viewed. What is environmentally acceptable to the industry is not necessarily acceptable to a planner, a politician, an environmentalist, or the general public. Reconciliation of these points of view is essential, and the tools for that are education (again), communication, cooperation, and good public relations, the last particularly by the construction materials industry, which in this context has the most to lose.

For the industry the options are to participate in the drafting of permitting and operating regulations, in cooperating with the regulators, in taking whatever actions are possible in assuring the regulators are well trained and that there is continuity in their personnel. On-site tours, educational materials, training manuals and short courses, support for the regulatory budget before the legislatures, all can be useful. At the other end of the operating schedule, long-range planning for reclamation is vital for the industry and the environment. The options for sequential, beneficial use can include lakes, parks, golf courses, subdivisions, and landfills (which can in turn be later reclaimed), with public participation in the planning an essential part of the process. If the industry can win the public's trust, it is probably better to wait until a site finally approaches closing—so that changes with time can better direct the best reclamation.

The other facet of environmentally responsible mineral extraction is the cost to the environment brought on by ignoring resource data. One very critical issue is that concern for the very local environment by the public (the NIMBY (Not In My Backyard) syndrome) can lead to importing needed materials from long distances at high costs. Ultimately every taxpayer pays these elevated costs. These costs not only include the cost of the materials, they also include wear and tear on roads, railroads, and equipment, as well as unnecessary fuel consumption. The second part of that same issue is that acquiring materials from areas where environmental controls are less stringent can lead to a form of exporting pollution, to moving environmental impacts of mining to sites that may be less able to recover from those impacts.

There are inadvertent effects on the spectrum of resources that are not only mineral, but include surface and ground water, wetlands, soils, the living resources of terrestrial, avian, and aquatic life, and the static resources of vistas and archeological sites.

The options available to deal with these environmental-cost issues put emphasis on adequate preplanning by planners and mine operators, by permittees and regulators, and all of these boil down, once again, to education, communication, and cooperation.

In summation, the Workshop's recommendations are numerous.

The needs for public awareness, education, and mutual sharing of information go hand in hand. The resource community (the operators, geologists, and first-level consumers of construction materials) must reach out to the public, the

planners, the regulators, and the legislators, through appearances at planning and zoning meetings, at committee hearings, at church groups and service clubs, at education association meetings and training sessions, and at schools to reach the future citizen early in the learning process. Means to disseminate information need to be examined and supported—the geological community now does so through the efforts of the American Geological Institute and the Geological Society of America, targeted mostly at teachers who deal with earth science in a general way. The industry should emphasize similar outreach, focused on the industrial rocks and minerals, by public relations efforts and educational endeavors through the State and national stone and aggregate producers associations, and locally by operators providing tours of quarries, mines, and plants, and of reclamation areas either in process or successfully completed. Industry must also establish greater credibility by taking the first steps in dealing with potential problems and by early cooperation rather than simple reaction. In all these efforts the resource community must target its audience carefully, and get the appropriate information to each of the various groups with which it deals.

The Workshop fully supported the effort to enact a National Geologic Mapping Act [Editors' Note: The act became law in May 1992], and it recommends the establishment of State mapping advisory boards to prioritize the needs for mapping, based on critical areas of need (land pressure–population growth–resources–geologic hazards). The Workshop recognizes the need for a Federal agency advisory committee to establish national priorities in conjunction with State needs.

A major area of concern for the resource community is the impact of planning, for urban or metropolitan or county or regional purposes. Those who plan have to be aware of the interrelationships among the many factors with which they deal. The Workshop recommends the establishment of data base systems that ensure the collection, preservation, and easy manipulation of the data on resources, hazards, transportation, power access, soils, flood plains, water availability, demographic patterns, and industrial sites. The technique widely known as GIS, Geographic Information Systems, allows for the segregation of such data and their integration selectively into many forms, by the capacity to overlay many different kinds of data onto combined maps. The Workshop emphasizes the desirability of GIS systems and fully supports and recommends their use.

The resource community and the planning community must work closely together. To avoid the loss of virtually irreplaceable mineral resources to urban sprawl, planners must give consideration to the need for and the location of immovable, nonrenewable resources. The Workshop recommends that the industry emphasize to the planning and regulating community that each extraction site, each quarry or mine, is unique, and that regulations must be flexible to deal equitably and effectively with them all. The Workshop

recognizes that establishment of the principle of sequential, beneficial land use is essential, and recommends that planners also recognize this principle as essential. Mining is a temporary land use, and reclamation of the ground allows for further beneficial use. The planning process requires full and truthful sharing and consideration of information by all the parties involved. Where urban sprawl is involved or anticipated, the concepts of service area boundaries (a type of zoning) and of limiting undesirable-growth-inducing facilities should be considered. Provision of a process to put into some type of "holding bank" resource areas that will be needed for use at some appropriate date needs to be examined, and probably addressed by State legislative action. Owners must be compensated adequately to give them an incentive to do something other than going into the types of development that would preclude future use of a mineral resource. More formally stated, the Workshop recommends that, "Land planners should include the need for industrial minerals in all planning considerations. In those areas where options by a planning commission to preserve access are limited, local and (or) State governments should consider legislation to preserve access to industrial minerals for the purpose of maintaining adequate quantities at a reasonable price."

Preservation of the environment and prevention of its degradation involve public, planners, and industry alike. The principle of sequential, beneficial land use recognizes

that. Industry must take a leadership role in environmentally responsible mineral extraction at the pit or mine, by recognizing the potential negative impacts of extraction and by proposing and employing appropriate methods to mitigate those impacts. Away from the pit, industry must play that role in public relations, by good communication, by education, by cooperation among all the parties concerned (regulators, permittees, planners, public). It must be a good neighbor, continuing to constantly abate noise and dust, to reduce transportation problems, to devise innovative and attractive reclamation techniques and projects. As a whole, the industry must help its operators to deal with new and frequently confusing regulations designed to protect and preserve the environment—one such dealing with storm-water discharge. The Workshop suggests that dealing with regulations is an appropriate opportunity for the trade associations to help their members. Industry can also be environmentally responsive and responsible by participating in recycling of construction materials, which can be economically fruitful as well.

And finally, both the Workshop and the industry recognize the need for increased research and development. However, with competition from producers standing in the way of the introduction of some sort of voluntary check-off system by members of the trade associations, it seems unfortunately likely that the industry will continue to depend solely on the funds dedicated by the National Stone Association.

APPENDICES—PERTINENT LEGISLATION, PERMITTING PROCEDURES, AND INDUSTRIAL MINERALS REFERENCE LIST

ARKANSAS

Pertinent legislation and permitting procedures

1. Responsible Agency/Division:

Arkansas Department of Pollution Control and Ecology
Surface Mining and Reclamation Division
8101 Interstate 30
Little Rock, AR 72219
(501) 570-2817 or 562-7444
FAX (501) 562-2541
Contact: Floyd Durham, Division Chief
Mike Thompson, Head, Non-coal permits
2. Objectives of the industrial minerals program:

The objective of permitting is to assure that open-cut mining is conducted in a manner that will protect the public health and safety and the environment and reclaim the land such that it is returned to a useful purpose.

The objective of the inspection program is to assure compliance with the applicable laws and regulations.

The Arkansas Department of Pollution Control and Ecology is the primary regulatory agency for open-cut mining.
3. Legal steps to open mining operations:

To obtain an open-cut mining permit, an applicant must comply with the following requirement:

 - a. Submit a permit application
 - b. Submit an application fee
 - c. Provide proof of the right to mine the land
 - d. Submit a mining plan
 - e. Submit a reclamation plan
 - f. Submit the required maps
 - g. Post a reclamation bond
 - h. Notify adjacent land owners
 - i. Notify the public of the permit application in a newspaper of local circulation.

These requirements are contained in Regulation 15, which was written pursuant to Arkansas Code Annotated 15-57-301 through 15-57-319.
4. Post-operation (closing) legal steps:

All land affected by open-cut mining operations must be reclaimed in accordance with the requirements of Arkansas Code Annotated 15-57-301 through 15-57-319 and

Regulation 15 written pursuant thereto. This could include, but may not be limited to, grading, revegetation, water diversion or water treatment. Final release from reclamation liability must come from the Department of Pollution Control and Ecology with advice from a Land Review Committee.

5. Local or county laws applicable in the above-mentioned categories:

None.

Industrial minerals reference list

Sites for purchasing or obtaining information about industrial minerals topics:

1. State Geological Survey list of publications:

Arkansas Geological Commission
Maps and Publications Section
Vardelle Parham Geology Center
3815 West Roosevelt Road
Little Rock, AR 72204
(501) 524-9165
FAX (501) 663-7360
2. University-related list of publications:

Contact the various universities, Geology Departments.
3. Pertinent State organizations:

Arkansas Department of Pollution Control and Ecology
Surface Mining and Reclamation Division
8101 Interstate 30
(501) 570-3827 or 562-7444
FAX (501) 562-2541

Arkansas State Mine Inspectors Office
Arkansas Department of Labor
616 Garrison Street, Suite 205
Ft. Smith, AR 72901
(501) 783-2103
4. State mineral industry directory:

Arkansas Geological Commission
Vardelle Parham Geology Center
3815 West Roosevelt Road
Little Rock, AR 72204
(501) 324-9165
FAX (501) 663-7360
5. Production reports:

Arkansas Geological Commission
Vardelle Parham Geology Center
3815 West Roosevelt Road
Little Rock, AR 72204
(501) 324-9165
FAX (501) 663-7360

6. State laws:

Arkansas Department of Pollution Control and Ecology
Surface Mining and Reclamation Division
8101 Interstate 30
Little Rock, AR 72219
(501) 570-2817 or 562-7444
FAX (501) 562-2541

Arkansas Geological Commission
Vardelle Parham Geology Center
3815 West Roosevelt Road
Little Rock, AR 72204
(501) 324-9165
FAX (501) 663-7360

Arkansas State Mine Inspectors Office
Arkansas Department of Labor
616 Garrison Street, Suite 205
Ft. Smith, AR 72901
(501) 783-2103

ILLINOIS

Pertinent legislation and permitting procedures

1. Responsible Agency/Division:

Illinois Department of Mines and Minerals
300 W. Jefferson St.
Suite 300, P.O. Box 10137
Springfield, IL 62791-1137
(217) 782-6791

Drilling permits:

Duane Pulliam
Oil and Gas Division
(217) 782-7756

Land Reclamation:

Dean Spindler
Land Reclamation Division
(217) 782-4970

Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, IL 62708
(217) 782-3397

Water Pollution:

Thomas McSwiggin
Permits, Water Pollution Control
(217) 782-0610

Air Pollution:

Don Sutton
Permits, Air Pollution Control
(217) 782-2113

Land Pollution:

Larry Eastep
Land/Permits, Land Pollution Control
(217) 782-6782

2. Objectives of the industrial minerals program:

To ensure environmentally sensitive use of land and water.

3. Legal steps to open mining operations:

Permits for the operation of pits and quarries:

The following permits are ordinarily required for the installation and operation of pits and quarries in Illinois:

a. Special use permit. Most pits and quarries operate in lands zoned for agriculture under a special use permit issued by local (usually county) zoning agencies. State agencies are not necessarily involved in this permitting process. Applications submitted and reviewed by the zoning board are then referred to the county board of supervisors for approval. Some counties require that a copy of the application also be submitted to the county soil and water conservation district whose response and report is required for the application to proceed.

b. Mining permit. A mining permit is required if the operation is to disturb more than 10 acres of land/year or involve the removal of more than 10 feet of overburden. The application goes to the Illinois Department of Mines and Minerals (IDMM) and at the same time is filed with the county clerk. IDMM prepares an Environmental Impact Statement (EIS) from information furnished by the applicant on a questionnaire that must be submitted upon application for the permit. The county has 45 days in which to respond. If no objections are lodged, IDMM issues the permit in a minimum of 60 days after the date of the application. If there are objections and call for a public hearing, the time period is extended indefinitely. Permits are for 3 years and are extendable for 1 year. Permits must be required for lateral expansion. If, after 3 years, no development has occurred on the property, the 1-year extension is limited to ¼ of the original acreage. IDMM permits are required for surface, not underground mines.

c. Construction and operating permits. Construction and operating permits from the Illinois Environmental Protection Agency (IEPA) are required. Applications must be accompanied by an EIS prepared by the applicant.

- d. Dredging permits. Dredge operations require a permit from the U.S. Army Corps of Engineers.
- e. Applicable regulations and codified laws.
62 Illinois Administrative Code 300.10-300.180.
State of Illinois Public Act 77-1568, Surface Mined Land Conservation and Reclamation Act.
Illinois Environmental Protection Agency Title 35, Subtitle D, Mine Related Pollution.
- 4. Legal steps to close mining operations:
 - a. Permitted operations must complete reclamation plans within 1 year of closure.
 - b. Applicable regulations and codified laws.
62 Illinois Administrative Code 300.10-300.180.
State of Illinois Public Act 77-1568, Surface Mined Land Conservation and Reclamation Act.
Illinois Environmental Protection Agency Title 35, Subtitle D, Mine Related Pollution.
- 5. Local or county laws applicable in above-mentioned categories.
Any not superseded by State law.

Industrial minerals reference list

Sites for purchasing or obtaining information about industrial minerals topics:

- 1. State Geological Survey list of publications:

Publication Sales
Illinois State Geological Survey
615 East Peabody Drive
Champaign, IL 61820
Orders: (217) 333-4747

- 2. University-related list of publications:

None that we are aware of.

- 3. Pertinent State organizations:

Mineral Resources and Engineering Branch
Illinois State Geological Survey
615 East Peabody Drive
Champaign, IL 61820
Requests: (217) 333-5116

Illinois Department of Mines and Minerals
330 W. Jefferson St.
Suite 300, P.O. Box 10137
Springfield, IL 62791-1137
(217) 782-6791

- 4. State mineral industry directory:

Publication Sales
Illinois State Geological Survey
615 East Peabody Drive
Champaign, IL 61820
Orders: (217) 333-4747

- 5. Production reports:

Publication Sales
Illinois State Geological Survey
615 East Peabody Drive
Champaign, IL 61820
Orders: (217) 333-4747

Pre-publication production data, when available:

Mineral Economics Section
Illinois State Geological Survey
615 East Peabody Drive
Champaign, IL 61820
Requests: (217) 333-7409

- 6. State laws:

See listings above of responsible agencies under “Pertinent legislation and permitting procedures.”

IOWA

Pertinent legislation and permitting procedures

- 1. Responsible Agency/Division:

Bureau of Mines and Minerals
Division of Soil Conservation
Department of Agriculture and Land Stewardship
(DALS)
Wallace State Office Building
Des Moines, IA 50319
(515) 242-5003 or 281-6142
Contact: Joe Pille

Geological Survey Bureau (GSB)
Energy and Geological Resource Division
Iowa Department of Natural Resources (IDNR)
109 Trowbridge Hall
Iowa City, IA 52242-1319
(319) 335-1575
FAX (319) 335-2754

- 2. Objectives of the industrial minerals program:

The objectives of the Department of Agriculture and Land Stewardship mineral program are limited to enforcing the laws and regulations contained in Code of Iowa, Chapter 83A, and The Iowa Administrative Code (IAC) 27—Chapter 60(83A).

The objectives of the Geological Survey Bureau–Iowa Department of Natural Resources mineral program are limited to enforcing the rules contained in Code of Iowa, Chapter 305.12 through 305.14.

3. Legal steps to open mining operations:
Iowa Code Chapter 83A requires mining operators to license, register, and bond all mining sites, specifically 83A.7, 83A.13, 83A.14, 83A.23, and 83A.24, and (IAC) 27-60.20(83A), -60.30(83A), -60.40(83A).
(Field trip guidebooks to quarries, pits, and outcrops around the State)
Central Materials Laboratory
Iowa Department of Transportation
800 Lincoln Way
Ames, IA 50010
(515) 239-1204
(Geologic records for quarries and pits from which the State of Iowa purchases road materials, and aggregate classification of those materials)
4. Legal steps to close mining operations:
Iowa Code Chapter 83A requires site reclamation, specifically 83A.17 and 83A.19, and (IAC) 27-60.80 (83A).
Office of Accounting
Iowa Department of Transportation
800 Lincoln Way
Ames, IA 50010
(515) 239-1588
(*Aggregate Source Information*, a listing of recently active quarries and pits)
5. Local or county laws applicable in the above-mentioned categories:
Local or county zoning laws may affect the opening, especially siting, of a new mineral extraction location; however, that information is not maintained by State agencies.

Industrial minerals reference list

Sites for purchasing or obtaining information about industrial minerals topics:

1. State Geological Survey list of publications:
Geological Survey Bureau
Energy and Geological Resource Division
Iowa Department of Natural Resources
109 Trowbridge Hall
Iowa City, IA 52242-1319
(319) 335-1575
FAX (319) 335-2754
(All industrial minerals pertinent to Iowa: crushed stone, sand and gravel, gypsum, clay, silica sand, cement rock, and underground mining regulations)
2. University-related list of publications:
Iowa State Mining and Mineral Resources Research Institute
288 Metals Development Building
Ames, IA 50011
(515) 294-7936
(Coal, gypsum, mine reclamation, mineral processing)
3. Pertinent State organizations:
Iowa Limestone Producers Association, Inc.
615 East 14th Street, Suite F
Des Moines, IA 50316
(515) 262-8668
FAX (515) 262-0299
(Crushed stone markets/suppliers)
Geological Society of Iowa
109 Trowbridge Hall
Iowa City, IA 52242-1319
(319) 335-1580
Attn: Paul Van Dorpe, Secretary-Treasurer
4. State mineral industry directory:
Bureau of Mines and Minerals
Division of Soil Conservation
Department of Agriculture and Land Stewardship (DALS)
Wallace State Office Building
Des Moines, IA 50319
(515) 242-5003 or 281-6142
Contact: Joe Pille
(*List of Registered Mineral Sites and Producers*, a listing of all currently registered mineral production sites)
5. Production reports:
U.S. Bureau of Mines-IFOC
P.O. 25086
Denver Federal Center
Denver, CO 80225
(303) 236-3400
Attn: Jeanne Zelten, Minerals Officer for Iowa
(Production survey statistics)
FOIA Officer for the
U.S. Bureau of Mines
2401 East Street N.W.
Washington, D.C. 20241
(202) 634-1340
(Production survey statistics)
Geological Survey Bureau
Energy and Geological Resource Division
Iowa Department of Natural Resources
109 Trowbridge Hall
Iowa City, IA 52242-1319
(319) 335-1575
FAX (319) 335-2754
(Limited production survey statistics)

6. State laws:

Bureau of Mines and Minerals
 Division of Soil Conservation
 Department of Agriculture and Land Stewardship
 (DALs)
 Wallace State Office Building
 Des Moines, IA 50319
 (515) 242-5003 or 281-6142
 Contact: Joe Pille
 (Rules and regulations for all types of surface mining
 and surface operations related to underground
 mining)

Geological Survey Bureau
 Energy and Geological Resource Division
 Iowa Department of Natural Resources
 109 Trowbridge Hall
 Iowa City, IA 52242-1319
 (319) 335-1575
 FAX (319) 335-2754
 (Rules related to mapping extent of underground mine
 workings)

KANSAS

Pertinent legislation and permitting procedures

1. Responsible Agency/Division:

a. Nonfuel industrial minerals:

At the present time, no State agency is involved since the nonfuel industrial mineral operations are not State regulated. Usually, the responsible agency is a city or county planning commission. The Kansas Department of Health and Environment is involved with respect to group permits and compliance to the storm water discharge rules of the Environmental Protection Agency. Operations are also inspected by personnel of the Mine Safety and Health Administration.

b. Coal:

Kansas Department of Health and Environment
 Surface Mining Section
 P.O. Box 1418
 Pittsburgh, KS 66762-1418
 (316) 231-8540
 Murray Balk, Chief

c. Oil and natural gas:

Kansas Corporation Commission
 202 West 1st Street
 Wichita, KS 67202
 (316) 263-3238
 Dave Williams

d. Exploratory drilling:

Shallow exploratory wells for industrial minerals are not regulated. However, the Kansas Corporation Commission (see address above) does like to know about such drilling in order to ensure proper plugging and to avoid possible contamination of fresh-water aquifers by salt-bearing waters.

2. Objectives of the industrial minerals program:

The Kansas Geological Survey is not involved in any regulatory capacity but does act in an advisory role with respect to providing information relating to possible sources of industrial minerals, past and present pit and quarry locations, properties of deposits that have undergone testing, and similar information. Data bases of past and present mineral operations and most test results compiled over the years are available for purchase. In addition, the Survey may perform laboratory research on industrial mineral samples in order to assist a new company get started or help a small company that does not have the resources to perform such testing.

3. See number 5. At the present time in Kansas, there are no statewide regulations pertaining to permitting, quarrying, and reclamation. One exception to this general rule occurs whenever the mining is expected to change the course of a drainage. In this case the State Water Board must approve the planned activity.

During the past 2 years (1991–92), bills have been proposed that would place permitting and reclamation under State regulations, but none has made it out of committee. It is generally acknowledged that it is only a matter of time before State regulations become law.

4. See number 5.

5. All aspects of permitting, mining, and reclamation of nonfuel industrial minerals in Kansas lie with the respective county and (or) city governments. Permits, environmental impact statements when necessary, etc., are usually brought before the county and (or) city planners and eventually approved by the respective planning commission. Since there are 105 counties in Kansas, there are 105 sets of rules to follow.

Industrial minerals reference list

Sites for purchasing or obtaining information about industrial minerals topics:

1. State Geological Survey list of publications:

Free upon request from:

Office of Sales and Publications
 The Kansas Geological Survey
 1930 Constant Avenue

The University of Kansas
Lawrence, KS 66047

2. University-related list of publications:

None with respect to industrial minerals at Kansas University, largely because the Kansas Geological Survey is located on the campus of the University. With regard to other universities in Kansas, one should write directly to the Department of Geology of schools including:

Emporia State University, Emporia, KS 66801-5087
Fort Hays State University, Hays, KS 67601
Kansas State University, Manhattan, KS 66506.
Wichita State University, Wichita, KS 67208-1595

3. Pertinent State organizations:

Kansas Department of Transportation
Research Materials Laboratory
2300 Van Buren
Topeka, KS
(913) 296-2231

Patrice Pomeroy, Public Information Department
Landon State Office Building
Topeka, KS
(913) 296-3769

Mine Safety and Health Administration
444 Southeast Quincy
Topeka, KS
(913) 295-2636

Kansas Department of Health and Environment
Environment Division
Forbes Building 740
Topeka, KS 66620
(913) 296-1535

Pertinent State industry organization:
KAPA-KRMCA
(Kansas Aggregate Producers Association—Kansas Ready-Mix Concrete Association)
Ed “Woody” Moses, Executive Director
800 Southwest Jackson
1408 Merchants National Bank Building
Topeka, KS 66612
(913) 235-1188

4. State mineral industry directory:

The Directory of Kansas Mineral Producers is available from the Office of Sales and Publications of the Kansas Geological Survey in computer printout form. The cost (1992) is \$5.00 plus an additional \$2.50 for handling and postage. The Directory can be obtained in two forms. MDIR.3 is an alphabetical listing of producers for each commodity while MDIR.4 lists producers by

county. Commodities include limestone (crushed and building), dolomite, sandstone (crushed and building), gypsum, salt, sand and gravel, clay, volcanic ash, coal and chats. The Survey also has two maps for sale, one showing the active operations while the other shows abandoned quarry locations.

5. Production reports:

Production reports are not available except for year-book chapters in cooperation with the U.S. Bureau of Mines. Many producers of industrial mineral commodities consider their production as confidential information and the Survey does not provide individual company production data.

6. State laws:

Not applicable.

KENTUCKY

Pertinent legislation and permitting procedures

Remarks: The outline used elsewhere in these appendices has been modified to present the information on Kentucky. In Kentucky, contacting the local governmental unit (county, city, town) is the first step.

- A. Outline of steps to open, operate, and close an industrial minerals operation. (Opening and closing an operation generally involve the same agencies, statutes, and regulations.)
 - B. County and City Government
 - C. Commonwealth of Kentucky
License/permit
Agency
Statutes and regulations (number and title)
- A. STEPS REQUIRED TO OPEN, OPERATE, AND CLOSE INDUSTRIAL MINERALS OPERATION
1. Contact local governmental unit (county, city, town) to determine the zoning classification, if any, for proposed site (see County and City Government below).
 2. Obtain permission from zoning authority to open and operate industrial minerals facility.
 3. Obtain applicable licenses and permits from Commonwealth of Kentucky agencies listed below.
 4. Information about performance and site-closing requirements should be obtained from State and local governmental agencies during the permitting and licensing process.

B. COUNTY AND CITY GOVERNMENT

1. Local Zoning

Zoning in Kentucky is enacted by local governmental units (county, city, town) and, consequently, varies across the State. A first step in the process of opening an industrial minerals operation should be to contact the local governmental unit in order to determine the zoning classification, if any, for the proposed site.

2. Lexington-Fayette Urban County Government

State's only merged city-county governmental unit has enacted ordinances regulating mining and quarrying:

- a. Zoning Ordinance 30-92 (Current contact person: Christopher King (606) 258-3184)
- b. Chapter 8 of Code of Ordinances (Current contact person: James Rebmann (606) 258-3175)

C. COMMONWEALTH OF KENTUCKY

1. Reclamation License and Permit

Non-coal Review Section
 Division of Field Services
 Department for Surface Mining Reclamation and Enforcement
 Natural Resources and Environmental Protection Cabinet
 No. 2 Hudson Hollow
 Frankfort, KY 40601
 (502) 564-2340
 Current contact person: Bob Mason

Kentucky Revised Statutes Chapter 350 Surface Coal Mining

Title 405 Kentucky Administrative Regulations
 Natural Resources and Environmental Protection Cabinet
 Department of Surface Mining Reclamation and Enforcement
 Chapter 5 Surface Effects of Non-coal Mining

2. Construction Permit

Division for Air Quality
 Department for Environmental Protection
 Natural Resources and Environmental Protection Cabinet
 316 St. Clair Mall
 Frankfort, KY 40601
 (502) 564-3382
 Current contact person: James Miller

Kentucky Revised Statutes Chapter 224 Environmental Protection

Title 401 Kentucky Administrative Regulations
 Natural Resources and Environmental Protection Cabinet

Department for Environmental Protection
 Division for Air Quality
 Chapter 50 General Administrative Procedures
 Chapter 51 New Source Requirements;
 Nonattainment Areas
 Chapter 53 Ambient Air Quality
 Chapter 59 New Source Standards
 Chapter 63 General Standards of Performance

3. Kentucky Pollutant Discharge Elimination System (KPDES) Permit
 Water Withdrawal Permit (if applicable)
 401 Water Quality Certification (if applicable)

Division of Water
 Department for Environmental Protection
 Natural Resources and Environmental Protection Cabinet

14 Reilly Road
 Frankfort, KY 40601
 (502) 564-3410
 Current contact person: Larry Sowder

Kentucky Revised Statutes Chapter 151 Geology and Water Resources
 Kentucky Revised Statutes Chapter 224 Environmental Protection

Title 401 Kentucky Administrative Regulations
 Natural Resources and Environmental Protection Cabinet
 Department for Environmental Protection
 Division of Water
 Chapter 4 Water Resources
 Chapter 5 Water Quality

4. Blaster's License

Explosives and Blasting Division
 Department of Mines and Minerals
 Public Protection and Regulation Cabinet
 P.O. Box 14080
 Lexington, KY 40512-4080
 (606) 254-0367
 Current contact person: Lawrence Schneider

Kentucky Revised Statutes Chapter 351 Department of Mines and Minerals

Title 805 Kentucky Administrative Regulations
 Public Protection and Regulation Cabinet
 Department of Mines and Minerals
 Chapter 4 Division of Explosives and Blasting

5. Clay Mine License

Licensing Division
Department of Mines and Minerals
Public Protection and Regulation Cabinet
P.O. Box 14080
Lexington, KY 40512-4080
(606) 254-0367

Kentucky Revised Statutes Chapter 351 Department of Mines and Minerals
Kentucky Revised Statutes Chapter 352 Mining Regulations

Title 805 Kentucky Administrative Regulations
Public Protection and Regulation Cabinet
Department of Mines and Minerals
Chapter 3 Surface Mining Safety Standards
Chapter 5 Division of Mining
6. Approval of aggregate sources and products for State contract work

Division of Materials
Department of Highways
Kentucky Transportation Cabinet
1227 Wilkinson Boulevard
Frankfort, KY 40622
(502) 564-3160
Current contact person: Wesley Glass
7. Registration for severance tax

Revenue Cabinet
P.O. Box 181
Frankfort, KY 40602
(502) 564-3667
Current contact person: Stacey Crume

Kentucky Revised Statutes Chapter 143A
Natural Resources Severance and Processing Taxes
1. State Geological Survey list of publications:

Kentucky Geological Survey
228 Mining and Mineral Resources Building
University of Kentucky
Lexington, KY 40506-0107
(606) 257-3896 (606) 257-5500
2. University-related list of publications:

George W. Pirtle Geological Sciences Library
100A Bowman Hall
University of Kentucky
Lexington, KY 40506-0059
(606) 257-5730
3. Pertinent State organizations:

State Government Information
Finance and Administration Cabinet
84 Capitol Annex
Frankfort, KY 40601
(502) 564-3130

Kentucky Geological Survey
228 Mining and Mineral Resources Building
University of Kentucky
Lexington, KY 40506-0107
(606) 257-5500

Regulatory Agencies
See items 1–7 above (under C. Commonwealth of Kentucky).
4. State mineral industry directory:

Kentucky Geological Survey
228 Mining and Mineral Resources Building
University of Kentucky
Lexington, KY 40506-0107
(606) 257-5500
(All industrial mineral commodities)

Regional Office of State Activities
U.S. Bureau of Mines
P.O. Box 18070
Pittsburgh, PA 15236
(412) 892-4423
(All industrial mineral commodities)

Division of Management Services
Transportation Cabinet
1026 State Office Building
Frankfort, KY 40622
(502) 564-6927
(Aggregate Source Book: crushed stone, sand and gravel)

Department of Mines and Minerals
Public Protection and Regulation Cabinet
P.O. Box 14080
Lexington, KY 40512-4080
(606) 254-0367
(Clay)
5. Production reports:

Regional Office of State Activities
U.S. Bureau of Mines
P.O. Box 18070
Pittsburgh, PA 15236
(412) 892-4423

(Summary data for all nonfuel commodities, unless withheld to avoid disclosing company proprietary data)

Department of Mines and Minerals
Public Protection and Regulation Cabinet
P.O. Box 14080
Lexington, KY 40512-4080
(606) 254-0367
(Clay)

6. State laws:

Legislative Research Commission
407 State Capitol
Frankfort, KY 40601
(502) 564-8100

MISSOURI

Pertinent legislation and permitting procedures

1. Responsible Agency:

Missouri Department of Natural Resources:

- a. Land Reclamation Program
P.O. Box 1368
Jefferson City, MO 65102
(314) 751-4041
Charles Stieffermann, Director
(Permits) Tom Cabanas
(Enforcement of land reclamation regulations)
- b. Air Pollution Control Program
P.O. Box 1368
Jefferson City, MO 65102
(314) 751-4817
Cindy Kemper, Director
(Permits) Randy Raymond
(Enforcement of clean air regulations)
- c. Water Pollution Control Program
P.O. Box 1368
Jefferson City, MO 65102
(314) 751-6721
Nicholas Di Pasquale, Director
(Permits) Richard Laux (314) 751-1300
(Enforcement of clean water regulations including NPDES permits and 401/404 approvals)
- d. Geological Survey Program
Wellhead Protection Section
P.O. Box 250
Rolla, MO 65401
(314) 368-2165
Ira Satterfield, Director

(Permits) Bruce Netzler (314) 368-2171
(Regulation and permitting of well drilling including exploratory test drilling and plugging standards)

e. Dam Safety Program

P.O. Box 250
Rolla, MO 65401
(314) 368-2175
Russell Adams
(Registration and inspection of all nonagricultural dams over 35 feet in height)

Missouri Department of Labor and Industrial Relations
Division of Labor Standards
P.O. Box 449
Jefferson City, MO 65102
(314) 751-3403
Clarence Barton, Assistant Director, State Mine Inspector
(Mine safety inspection for clay and shale, silica sand, and granite)

Office of Secretary of State
Corporations Division
600 West Main
Jefferson City, MO 65101
(314) 751-3200
Linda Oliver, Director
(Responsible for the registration of all businesses operating in the State)

2. Objectives of the industrial minerals program:

To ensure environmentally responsible and safe mining practices.

3. Legal steps to open mining operations:

Regulations and permitting requirements vary greatly with commodity and type of mining planned, but, in general, three permits are necessary—land reclamation, clean air, and clean water. Public hearings may be required, and in addition, cities and counties with zoning regulations may require additional hearings and permitting procedures.

Land reclamation:

Applicable statutes: RSMO 444.760 to 444.789
Applicable rules: In preparation

Air pollution control:

Applicable statutes: RSMO 643.075
Applicable rules: 10 CSR 10-6.060, 10 CSR 10-6.020

Water pollution control:

Applicable statutes: RSMO 644

Applicable rules: 10 CSR 20-6.010, 10 CSR 20-6.0111

The following may apply:

Well-head protection (Geological Survey):

Applicable statutes: RSMO 256.600

Applicable rules: In preparation

Dam safety:

Applicable statutes: RSMO 236.400 to 236.500

Applicable rules: 10 CSR 22-3.0020 and 10 CSR 22-3.040

Mine safety:

Applicable statutes: RSMO 293.010 to 293.690

Business registration:

Applicable statutes: RSMO 351.010 to 351.720
(General and Business Corporations)

4. Legal steps to close mining operations:

Regulations vary, but all environmental regulations must be met and in particular all reclamation must be completed before bonding is released. See items listed under "Legal steps to open mining operations," some of which may apply.

5. Local or county laws applicable in the above-mentioned categories:

Most urban and some rural counties have zoning, and, although requirements vary, all require some type of special use permit and public hearings.

Industrial minerals reference list

Sites for purchasing or obtaining information about industrial minerals topics:

1. State Geological Survey list of publications:

Publications
Missouri Department of Natural Resources
Division of Geology and Land Survey
P.O. Box 250
Rolla, MO 65401
(314) 368-2125

2. University-related list of publications:

Some universities and colleges may also provide information on industrial minerals in Missouri.

3. Pertinent State organizations:

Missouri Department of Natural Resources
Geological Survey Program
P.O. Box 250
Rolla, MO 65401
(314) 368-2100

James H. Williams, State Geologist
(314) 368-2149

Ira Satterfield, Geological Survey Program
Director

Geologic Mapping and Resources
(314) 368-2155

A.W. Rueff

(314) 368-2139

(Industrial minerals, producers directory,
mineral statistics)

Missouri Highway and Transportation Department
Division of Materials and Research

P.O. Box 270

Jefferson City, MO 65201

(314) 751-2551

William L. Trimm, Division Engineer

(Inspects and tests all material used in the construction
and maintenance of the State highway system)

Department of Economic Development

Economic Development Programs

P.O. Box 1157

Jefferson City, MO 65101

(314) 751-4241

Garry Taylor, Deputy Director

(Administers and coordinates numerous programs to
improve the economic conditions of the State)

Missouri Limestone Producers Association

P.O. Box 1725

Jefferson City, MO 65102

(314) 635-0208

Steve Rudloff, Executive Manager

(Industry organization representing crushed limestone
producers)

Mining Industry Council of Missouri

P.O. Box 725

Jefferson City, MO 65102

(314) 635-7308

Randy Scherr, Director

(Mineral industry organization representing all types of
mining, including the industrial minerals barite,
cement and lime, clay, industrial sand, sand and
gravel, and stone)

4. State mineral industry directory:

Missouri Department of Natural Resources

Division of Geology and Land Survey

P.O. Box 250

Rolla, MO 65401

(314) 368-2139

A.W. Rueff

- Missouri Limestone Producers Association
(Members only)
Address in item 3.
- Mining Industry Council of Missouri
(Members only)
Address in item 3.
5. Production reports:
- U.S. Bureau of Mines
Intermountain Field Operations Center
Building 20, Denver Federal Center
Denver, CO 80225
(303) 236-3400
Jeanne Zelten
- Missouri Department of Natural Resources
Division of Geology and Land Survey
P.O. Box 250
Rolla, MO 65401
(314) 368-2139
A.W. Rueff
6. State Laws (environmental):
- Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102
(314) 751-4817
See also addresses listed under item 1.
- (In charge of leasing for oil, gas, and surface minerals on State land)
- Department of Environmental Quality
301 Centennial Mall South
P.O. Box 98922
Lincoln, NE 68509-8922
(402) 471-2186
(Regulatory agency for mineral exploration drilling, waste disposal, underground mining, air and water quality)
- U.S. Army Corps of Engineers
Regulatory Office
1430 Central Avenue, Suite 4
Kearney, NE 68847
(308) 237-1403
(In charge of permits for operations in or near waters of the United States)
- U.S. Department of Labor
Mine Safety and Health Administration
Rocky Mountain District Office
Metal and Nonmetal Mine Safety and Health
Box 25367, Denver Federal Center
Denver, CO 80225-0367
(303) 231-5465
(Mining inspections for noise, dust, and mining safety)

NEBRASKA

Pertinent legislation and permitting procedures

1. Responsible Agency/Division:
- Regulatory Agency:
- There is no central State agency in Nebraska to handle permitting for mineral operations. Industrial mineral operations fall under the jurisdiction of a variety of city, State, and Federal agencies as well as local government organizations through zoning regulations. Permits related to the environment are issued by various agencies for quarries, pits, and mines.
- a. Private property:
- No contact or regulatory agency for quarrying or mining on private property.
- b. State property:
- Board of Educational Lands and Funds
555 North Cotner Boulevard
Lincoln, NE 68505
(402) 471-2014
- U.S. Nuclear Regulatory Commission
Uranium Recovery Field Office
Box 25325, Denver Federal Center
Denver, CO 80225
(303) 231-5800
(In charge of permits for uranium mining)
- c. Federal property:
- U.S. Bureau of Land Management
1101 Washington Boulevard
New Castle, WY 82701
(307) 746-4453
(In charge of leasing for surface or subsurface mineral resources including oil and gas on Federal or split estate lands. Also in charge of oil and gas leasing on Indian Land in Nebraska, but surface minerals on Indian Land are leased by individual Indian Tribal Councils)
- U.S. Bureau of Land Management
Wyoming State Office
2515 Warren Avenue
Cheyenne, WY 82001
(307) 775-6256

(In charge of leasing for geothermal resources on Federal land in Nebraska)

U.S. Army Corps of Engineers
Regulatory Office
1430 Central Avenue, Suite 4
Kearney, NE 68847
(308) 237-1403

(In charge of permits for operations in or near waters of the United States)

Responsible non-regulatory Agency/Division:

Nebraska Geological Survey
Raymond R. Burchett, Director
Conservation and Survey Division (IANR)
Institute of Agriculture and Natural Resources
901 N. 17th Street
University of Nebraska—Lincoln
Lincoln, NE 68588-0517
(402) 472-7520

2. Objectives of the industrial minerals program:

To inventory, describe, and encourage industrial mineral production in an environmentally wise-use manner and to report to the public the results of these studies.

3. Legal steps to open mining operations:

- a. Contact local County Board of Commissioners for a permit to open a quarry or mining operation, or the U.S. Army Corps of Engineers, if applicable, at address in item 1.

Section 404 Permit. A permit and prior authorization is required before any dredging or filling operation is performed on any water of the United States, including wetlands.

Section 10 Permit. A permit is required for dredging in any stream of the United States defined as navigable.

- b. State laws 72-301 through 72-311 permit leasing and exploration on State land.

See applicable entries under item 1 above.

4. Legal steps to close mining operations:

Contact appropriate agency that issued the permits.

5. Local or county laws applicable in the above categories:

Each city and county has the authority to regulate industrial minerals through zoning ordinances and land-use planning.

Industrial minerals reference list

Sites for purchasing or obtaining information about industrial minerals topics:

1. State Geological Survey list of publications:

Nebraska Geological Survey
Conservation & Survey Division (IANR)
113 Nebraska Hall, 901 N. 17th Street
University of Nebraska—Lincoln
Lincoln, NE 68588-0517
(402) 472-7523
(Listing of mineral resource publications)
(To obtain county soils maps and reports)
(To obtain topographic maps)

2. University-related list of publications:

Nebraska Geological Survey
Conservation & Survey Division (IANR)
113 Nebraska Hall, 901 N. 17th Street
University of Nebraska—Lincoln
Lincoln, NE 68588-0517
(402) 472-7523
(To obtain a list of all masters theses and doctoral dissertations from the University of Nebraska—Lincoln)

Department of Geology Library
Bessey Hall 10
12th and U St.
University of Nebraska—Lincoln
Lincoln, NE 68588-0332
(402) 472-2653
(To obtain references on mineral-related subjects)
Other colleges in Nebraska may also be able to provide information on industrial minerals.

3. Pertinent State or Federal organizations:

Board of Educational Lands and Funds
555 North Cotner Boulevard
Lincoln, NE 68505
(402) 471-2014
(In charge of leasing for oil, gas, and surface minerals on State land)

Department of Environmental Quality
301 Centennial Mall South
P.O. Box 98922
Lincoln, NE 68509-8922
(402) 471-2186

(Regulatory agency for mineral exploration drilling, waste disposal, underground mining, air and water quality)

Nebraska Oil & Gas Conservation Commission

P.O. Box 399

Sidney, NE 69162

(308) 254-4595

(Regulatory agency for oil and gas industry including underground injection wells)

Health Department

State of Nebraska

301 Centennial Mall South

Lincoln, NE 68509

(402) 471-2133

(Regulatory agency for any radiometric measurements)

Nebraska Department of Water Resources

301 Centennial Mall South

Lincoln, NE 68509

(402) 471-2363

(In charge of permits for domestic and municipal water wells)

Nebraska Department of Roads

Box 94759

State House Station

Lincoln, NE 68508

(402) 471-4567

(Information on materials resources for State construction work)

Nebraska Department of Revenue

501 Centennial Mall South

Lincoln, NE 68509

(402) 471-2971

(Collects severance tax on oil, gas, and uranium)

U.S. Bureau of Land Management

Wyoming State Office

2515 Warren Avenue

Cheyenne, WY 82001

(307) 775-6256

(In charge of leasing for geothermal resources on Federal land in Nebraska)

U.S. Bureau of Land Management

1101 Washington Boulevard

New Castle, WY 82701

(307) 746-4453

(In charge of leasing for surface or subsurface mineral resources including oil and gas on Federal or split estate lands. Also in charge of oil and gas leasing on Indian Land in Nebraska, but surface minerals on

Indian Land are leased by individual Indian Tribal Councils)

U.S. Army Corps of Engineers

Regulatory Office

1430 Central Avenue, Suite 4

Kearney, NE 68847

(308) 237-1403

(In charge of permits for operations in or near waters of the United States)

U.S. Soil Conservation Service

100 Centennial Mall North

Federal Building

Lincoln, NE 68508-3866

(402) 437-5322

(To obtain county soils maps and reports)

U.S. Nuclear Regulatory Commission

Uranium Recovery Field Office

Box 25325, Denver Federal Center

Denver, CO 80225

(303) 231-5800

(In charge of permits for uranium mining)

U.S. Department of Labor

Mine Safety and Health Administration

Rocky Mountain District Office

Metal and Nonmetal Mine Safety and Health

Box 25367, Denver Federal Center

Denver, CO 80225-0367

(303) 231-5465

(Mining inspections for noise, dust, and mining safety)

U.S. Environmental Protection Agency

Region 7

726 Minnesota Avenue

Kansas City, KS 66101

(913) 551-7006

(Air and water quality, waste disposal)

4. State mineral industry directory:

Nebraska Geological Survey

Conservation and Survey Division (IANR)

113 Nebraska Hall, 901 N. 17th Street

University of Nebraska—Lincoln

Lincoln, NE 68588-0517

(402) 472-7523

(Contains a listing of all active quarries, pits, and mines and associated information)

Nebraska Concrete & Aggregates Association

2701 N. 61st St.

Lincoln, NE 68507

(402) 464-1897

(Contains a listing of sand and gravel operators belonging to the association)

5. Production reports:

U.S. Bureau of Mines
Building 20, Denver Federal Center
Denver, CO 80225
(303) 236-0435
(The Mineral Industry of Nebraska, Mineral Industry Surveys)

Nebraska Geological Survey
Conservation & Survey Division (IANR)
113 Nebraska Hall, 901 N. 17th Street
University of Nebraska—Lincoln
Lincoln, NE 68588-0517
(402) 472-7523
(Annual Report on Mineral Operations Review in Nebraska)

6. State Laws:

Applicable State laws and regulations can be obtained from the individual State agencies that have administrative responsibility for each of these laws. Refer to the list of laws above.

OKLAHOMA

Pertinent legislation and permitting procedures

1. Responsible Agency/Division:

Oklahoma Department of Mines
Non-Coal Division
4040 North Lincoln, Suite 107
Oklahoma City, OK 73105
(405) 521-3859
Contact: Douglas J. Schooley, Administrator

2. Objectives of the industrial minerals program:

To provide for the reclamation and conservation of land disturbed by mining and to preserve natural resources to encourage the productive use of such lands after mining.

3. Legal steps to open mining operations:

Specific statutory requirements for permitting of non-coal mining operations are found under Title 45, Chapter 8A of "The Mining Lands Reclamation Act," sections 721–738. Non-Coal Rules and Regulations, OAC 460:10, sections 1–31 cover the permitting process, bonds, and blasting plan.

Submit the following:

- a. Formal application: operator's name, address, phone; mining method, legal description, acreage requested.
- b. Reclamation plan, with maps.
- c. Location map (one per land section).
- d. Blasting plan.
- e. Reclamation bond.
- f. Public notification by local circulation newspaper.

4. Post-operation (closing) legal steps:

As of April 30, 1993, new statutory regulations were being prepared, encompassing significant changes from the preceding regulations. Contact the Non-Coal Division of the Oklahoma Department of Mines at the above address for current status.

5. Local or county laws applicable in the above-mentioned categories:

Most major metropolitan areas have local laws and regulations affecting the mining of industrial minerals through zoning procedures.

Industrial minerals reference list

1. State Geological Survey List of Publications:

Oklahoma Geological Survey
100 East Boyd, Room N-131
Norman, OK 73019
(406) 325-3031

2. University-related List of Publications: None of the State Universities publishes reports, journals, or books dealing with mineral resources, but there are three universities with M.S. and (or) Ph. D. programs in geology that produce theses and dissertations that may be of use in mineral-resource evaluation.

School of Geology and Geophysics
University of Oklahoma
100 East Boyd, Room 810
Norman, OK 73019
(406) 325-3253

School of Geology
Oklahoma State University
105 Noble Research Center
Stillwater, OK 74078
(405) 744-6358

Department of Geosciences
University of Tulsa
Tulsa, OK 74104
(918) 631-2517

3. Pertinent State Organizations: A “Directory of Oklahoma,” containing descriptions of all State agencies, is available from:

Oklahoma Department of Libraries
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502

4. State Mineral Industry Directory:

Oklahoma Geological Survey
100 East Boyd, Room N-131
Norman, OK 73019
(405) 325-3031

5. Production Reports: In annual report of:

Oklahoma Department of Mines
4040 North Lincoln, Ste. 107
Oklahoma City, OK 73105
(405) 521-3859

6. State Laws:

Oklahoma Department of Mines
4040 North Lincoln, Ste. 107
Oklahoma City, OK 73105
(405) 521-3859

TENNESSEE

Pertinent legislation and permitting procedures

1. Responsible Agency/Division

Mining Section, Division of Water Pollution Control
Department of Environment and Conservation
2700 Middlebrook Pike
Knoxville, TN 37921
(615) 594-6035
Contact: Carl Tenut

2. Objectives of the industrial minerals program:

To regulate the surface mining of minerals other than coal; to protect the environment by proper methods of mining and reclamation.

3. Legal steps to open mining operations:

Comply with Tennessee Mineral Surface Mining Law of 1972, sections 59-8-201 to 59-8-22.

- a. Obtain mining permit and NPDES permit:

1. Provide name of organization, offices, responsible parties, site location.
2. Provide maps.
3. Submit mining and reclamation plans.
4. Publish public notice.

5. Post bonds as appropriate.

4. Post-operation (closing) legal steps:

Comply with Tennessee Mineral Surface Mining Act of 1972, section 59-8-208.

- a. Reclaim

1. To approximate original contours of surface.
2. Vegetate.

5. Local or county laws applicable in the above-mentioned categories:

Some counties have their own mining, reclamation, and zoning laws.

Industrial minerals reference list

Sites for purchasing or obtaining information about industrial minerals topics:

1. State Geological Survey list of publications:

Tennessee Department of Environment and Conservation
Division of Geology
Map Sales and Publication Office
L and C Tower, 13th Floor
401 Church Street
Nashville, TN 37243-1530
(615) 532-1500

2. University-related list of publications:

Tennessee Department of State
Division of Publications
James K. Polk State Office Building, Suite 500
Nashville, TN 37243-0310
(615) 741-2650

3. Pertinent State organizations:

Tennessee Department of State
Division of Publications
James K. Polk State Office Building, Suite 500
Nashville, TN 37243-0310
(615) 741-2650

4. State mineral industry directory:

Tennessee Department of Environment and Conservation
Division of Geology
Map Sales and Publication Office
L and C Tower, 13th Floor
401 Church Street
Nashville, TN 37243-1530
(615) 532-1500

5. Production reports:

Tennessee Department of Environment and
Conservation
Division of Geology
Map Sales and Publication Office
L and C Tower, 13th Floor
401 Church Street
Nashville, TN 37243-1530
(615) 532-1500

U.S. Bureau of Mines
810 Seventh Street NW, MS 9800
Washington, D.C. 20241-0001

6. State Laws:

Tennessee Department of State
Division of Publications
James K. Polk State Office Building, Suite 500
Nashville, TN 37243-0310
(615) 741-2650

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