



**Dig A Little Deeper  
Find Out**



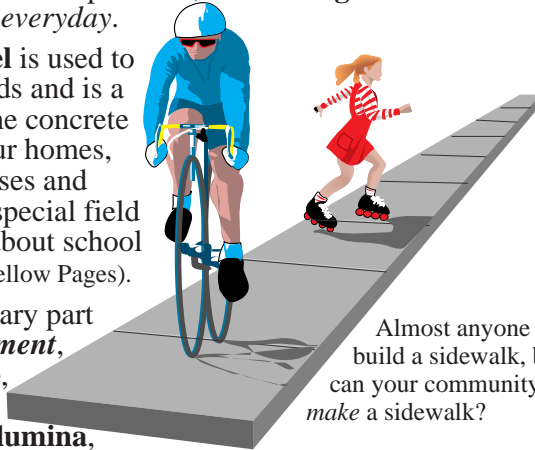
**Where The Sidewalk Begins**

Virtually every community in America has a mine or quarry nearby, one that provides, **sand and gravel**—*minerals we use everyday.*

**Sand and gravel** is used to build all our roads and is a critical part of the concrete that is used in our homes, schools, businesses and factories. For a special field trip, call to see about school tours (check the Yellow Pages).

The other necessary part of concrete is **cement**, made from **shale, clay, quartz, gypsum, iron, alumina, manganese**, and most important, **limestone**.

**To make the things we use, each year more than 4,700 pounds of concrete is produced for every person in the United States.**



Almost anyone can build a sidewalk, but can your community make a sidewalk?

If you can see it, touch it, taste it, smell it, or hear it, It's from our Natural Resources.

**Anybody can build a sidewalk. But can your community make a sidewalk?**

*Eleven states don't even produce cement the essential ingredient to make concrete. Some communities do not have a sand and gravel mine nearby. How far away does your community need to go to find the materials to make a sidewalk?*

**SCIENCE**

In cooperative groups research how concrete is made and how cement is made. What is the difference? Take a walking field trip to locate examples of how concrete is used in and around your school.

Examine broken pieces to see what it looks like. Mix "concrete" using the recipe found on page 3. Limestone is the most important part of cement and, therefore, concrete. It's also in candy bars and toothpaste.

**ART**

Using the recipe on page 7, create art objects such as garden stepping stones, paper weights, molded figures. Draw pictures or make a collage of items made of concrete.

**P.E.**

Use sidewalk chalk to create sidewalk drawings and games.

**LANGUAGE ARTS**

Read *Where The Side Walk Ends*. Create your own sidewalk poems. Write short research papers on quarrying and aggregate mining (there is a difference), or the various kinds of concrete.

**MATH**

Using the information in the box above, determine how many pounds of concrete are produced each year for your class. Weigh samples of concrete using standard & metric measures. Calculate volume measurements on page 2.

Measuring by weight. Measuring by volume. How much concrete do you need to fly on an airplane?

**HISTORY**

Research: Romans and the development of cement and concrete used in buildings that still stand. Building of the Erie Canal. Georgia granite was used in the Panama Canal. Why? Find out about Joseph Aspden and Portland Cement, named after the Isle of Portland on the south coast of England.

**Read More About It**

*The Magic School Bus Inside The Earth,*

by Joanna Cole

*The Super Science Book of Rocks and*

*Soils,* by Robert Snedden

*Mineral Resources,* World's Resources

Series by Robin Kerrod

*How We Build Dams,* by Neil Ardley.

*The Big Book of Real Skyscrapers,* by

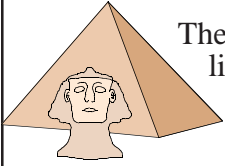
Gine Ingoglia, 1989, Grosset & Dunlap

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# What would life be like without concrete?

## Visit a local mine and find out how it all begins



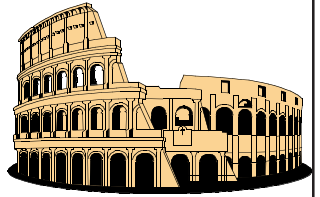
The Egyptians used a cement-like material (containing gypsum) to make the Great Pyramid in 2600 B.C.

**Some of the world's smartest people don't know the difference between concrete and cement.**

It's simple. *Concrete* is the finished product, such as sidewalks, foundations, and the surface of many roads. Concrete contains sand, gravel, and cement. *Cement* is the special hardening ingredient (the gray powder) that makes concrete harden. Cement is usually made of 60% lime (limestone), 25% silica, 5% alumina, and 10% other materials, such as gypsum and iron oxide.

**Now you know!**

The ancient Romans developed a special concrete that set up while underwater (a hydraulic cement). Their special mixture contained lime and volcanic ash. Their concrete was so strong that many of their buildings, bridges, and roads still exist today, 2,000 years after they were built.



The average American house contains 120,528 pounds of concrete, 15,300 pounds of concrete block, and 75,400 pounds of sand, gravel, and bricks. In total, more than a quarter of a million pounds of different minerals and metals are contained in the *average* American home.

Five states produce nearly 50% of all the cement made in America. They are (in order): California; Texas; Michigan; Pennsylvania; and Missouri.

## Airports and Runways

There are about 17,000 airports in the United States, covering more than 4 million acres of land.

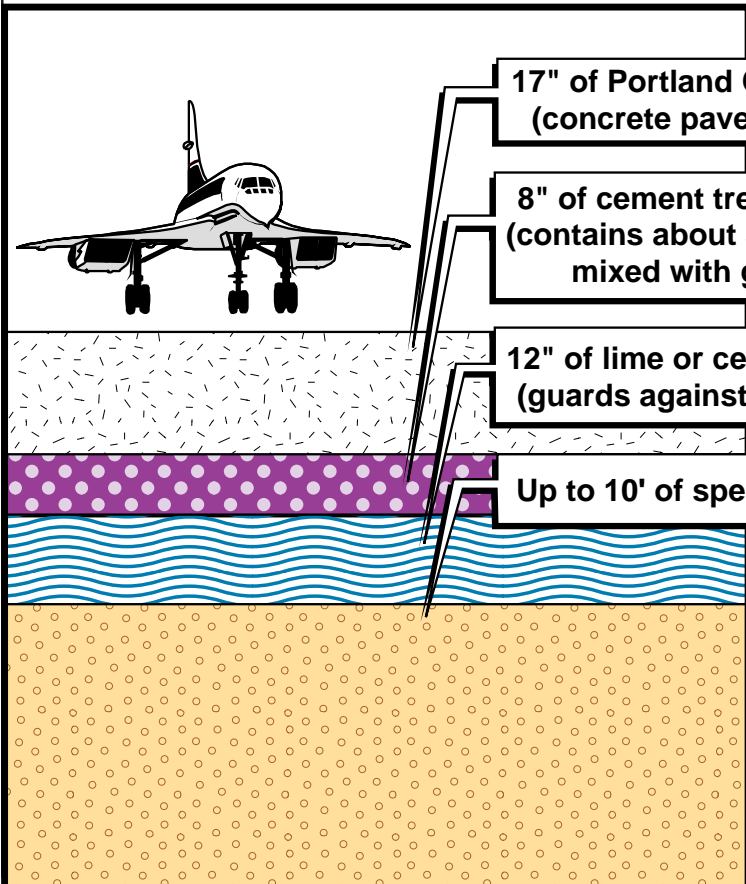
While it is virtually impossible to estimate the amount of sand, gravel, stone, and cement used to build those airports, this information can help you begin to appreciate the amount of mining that must occur so people can fly.

There are more than 281,000 non-military airplanes in the U.S., 7,400 of which are the commercial carriers (the airline companies).

The carriers travelled more than 5,473,562,000 miles in 1995, involving 8,053,582 different trips, with 547,384,000 passengers on those planes.

The amount of minerals and metals needed to build those airplanes is unknown, but they consume more than 13 billion gallons of fuel each year.

All of the above information is for the United States only. When you think about the rest of the world, all of these numbers and the minerals, metals and fuel needed, increase dramatically.



## Roads & Highways

There are more than 2,336,000 miles of hard-surfaced roads in the United States. The majority of those roads do not have both asphalt and concrete surfaces, like the *ultimate* road shown below. However, a two-lane road is at least 24-feet wide, so you can begin to estimate the amount of materials that were mined to construct the roads we use everyday.

There are more than 1,571,000 miles of dirt roads in the U.S. And every year, they need more dirt put on top of them because driving makes the dirt disappear. It disappears as dust when the sand and rocks are worn finer and finer by the weight of cars.

Roads cover 31,701,760 acres of land. Passenger cars and small trucks consumed more than 111,375 million gallons of fuel each year.

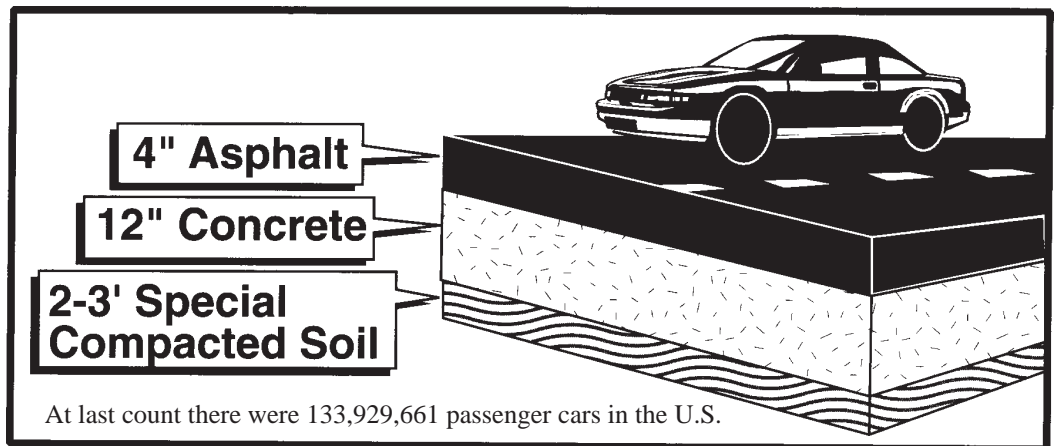
Quarry,  
Cement,  
Concrete

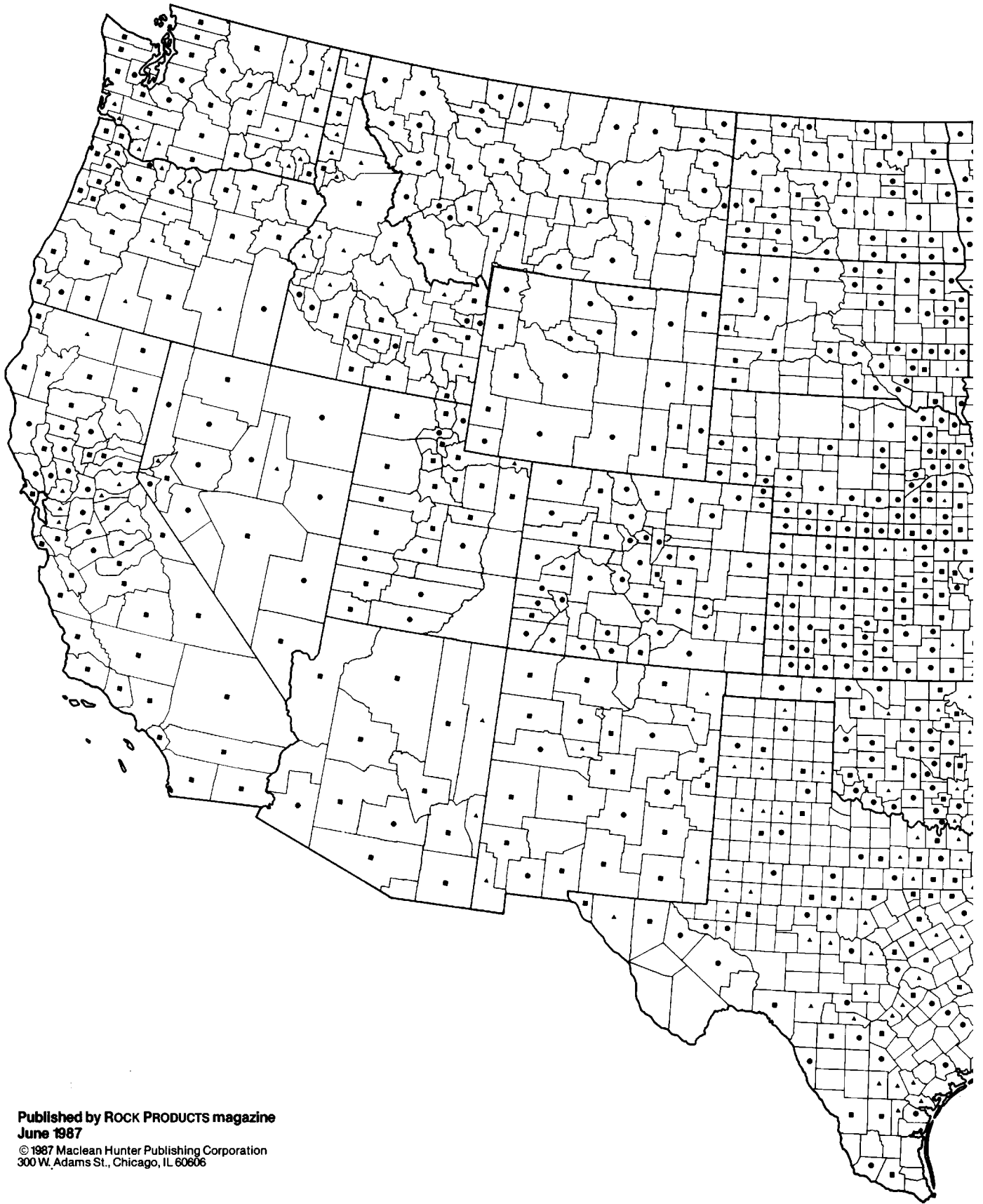
- Facts**
1. Quarrying is a method of taking large solid blocks or broken masses of stone from the earth & preparing them for construction.
  2. Some quarries are in the side of a mountain.
  3. Most quarries are open at the surface.
  4. Quarries in the US are constantly being opened & shut down. Find out if a park or golf course near you used to be a quarry.
  5. In the late 1970's about 900 million short tons (820 million metric tonnes) of stone were quarried annually in the United States.
  6. Most cement plants are located near limestone quarries. (Have students reason why.)
  7. The US produces about 67 million short tons (61 million metric tons) of portland cement a year—about 1/10 of the world's total.
  8. Other major cement producers are China, France, Italy, Japan, Russia, Germany.
  9. Concrete is fireproof & watertight.
  10. Skyscrapers & bridges are made of reinforced (with steel) concrete.
  11. Concrete shrinks as it hardens.
  12. Hot & cold weather effect the "curing" time of concrete.

1. Locate and highlight your state. (Enlarge relevant section of the map for your use)
2. Count the geometric shapes/symbols in your state. Identify symbols by name.
3. Locate your immediate community.
4. Classify and graph the symbols in your state.
5. Research in the Yellow Pages the names of local quarries and/or sand and gravel pits.
6. Write a letter to a local quarry.
7. Take a field trip to a local quarry and/or invite a guest speaker.
8. Research where the raw materials to make cement are found.
9. Discussion—Can your community supply all of the resources needed to build a sidewalk?
10. In cooperative groups, research and list all of the uses for concrete.



Map & Math  
Activities

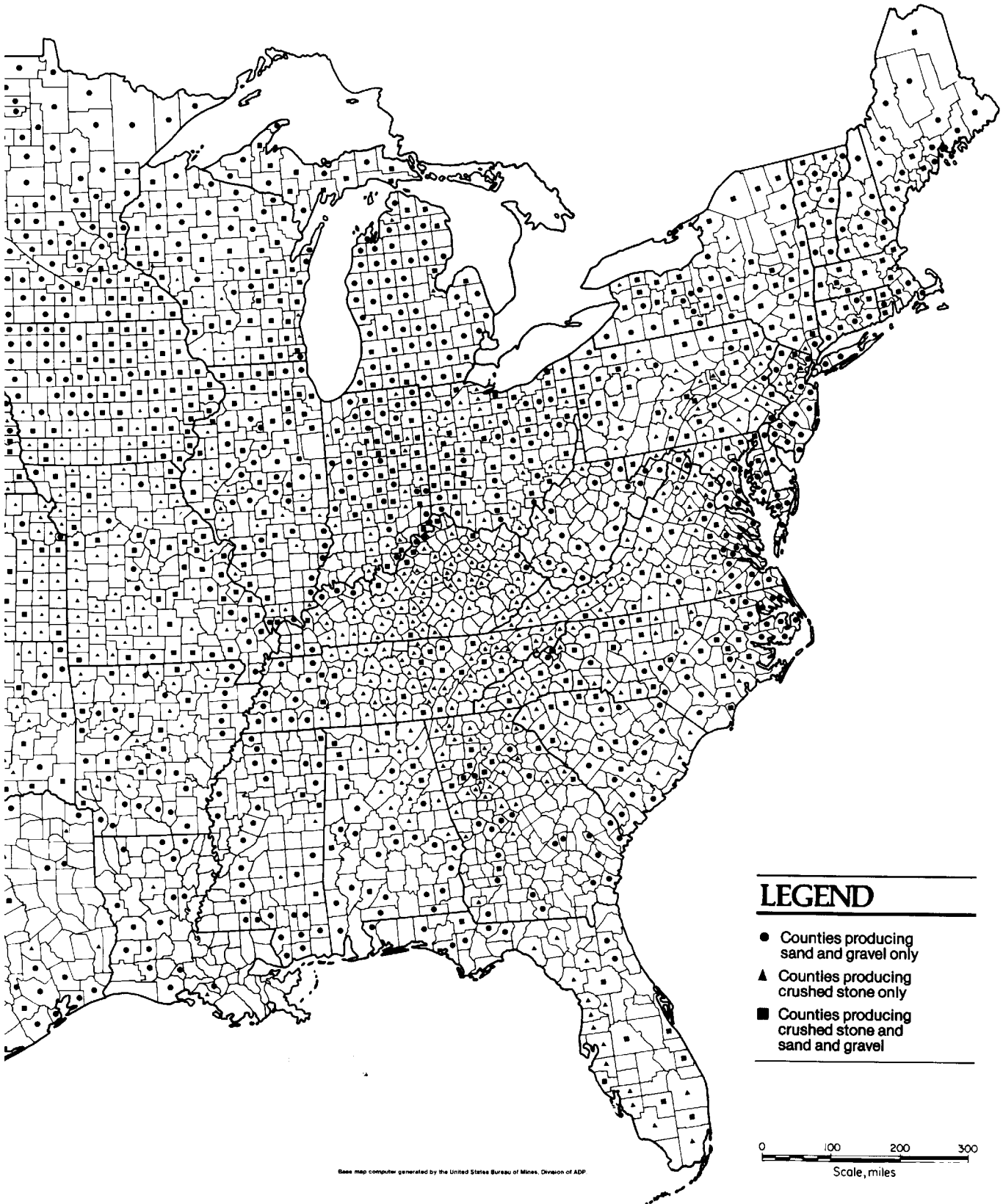




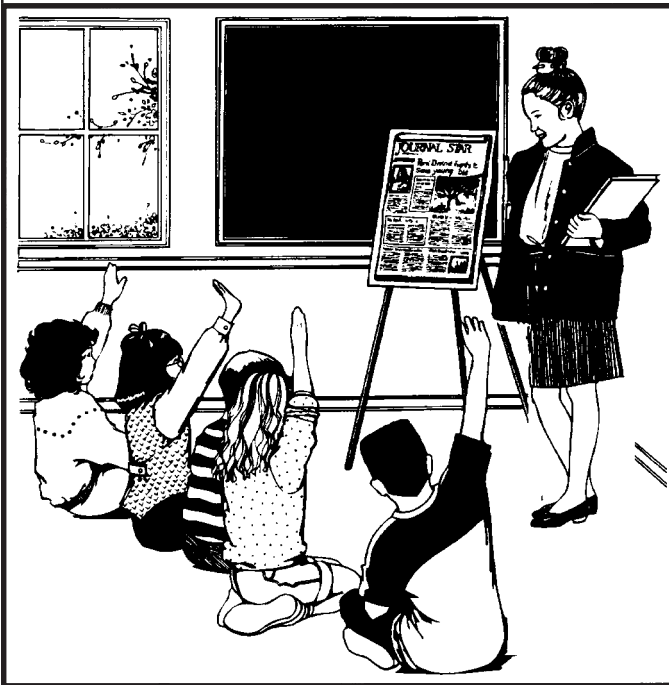
Published by ROCK PRODUCTS magazine  
June 1987  
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300 W. Adams St., Chicago, IL 60606

# Crushed Stone Quarry and Sand & Gravel Pit Map

Counties containing crushed stone, sand & gravel, and aggregate operations



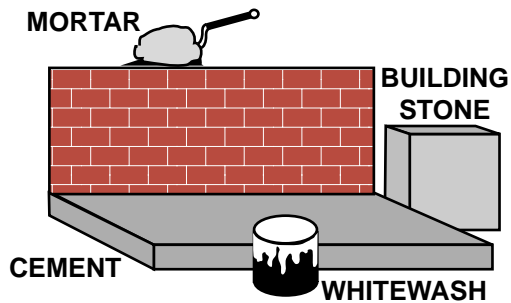
Limestone is working for you, everyday.  
 At your school At your home



Can you find all the ways limestone is used?

## THE MANY USES OF LIME AND LIMESTONE

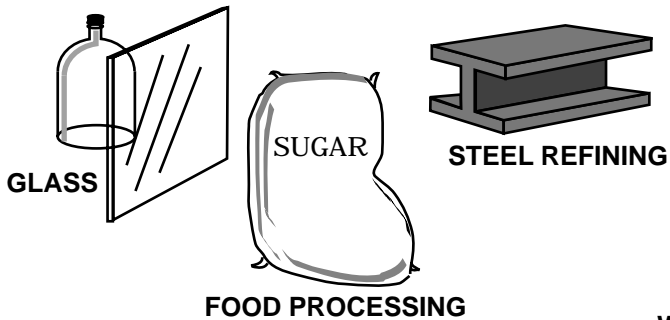
### CONSTRUCTION



### TANNING AND FARMING



### MANUFACTURING



### OTHER USES



### Recommended concrete mix

This mix makes about 4 cubic feet (0.1 cubic meter) of concrete, enough to make 12 sq. ft. of sidewalk, 3 inches thick.

Material	By Volume	By Weight	By Ratio
Cement	1 bag, or 1 cu ft (0.03 cu m)	94 lbs (43 kg)	1 part
Water	5.5 gal (21 liters)	46 lbs (21 kg)	as needed
Sand	2 cu ft (0.06 cu m)	20-0 lbs. (91 kg)	2 parts
Coarse aggregate*	3 cu ft (0.08 cu m)	260 lbs (118 kg)	3 parts

\* Particles graded 1/4 to 3/4 inch (6 to 19 mm) in size

**Cement is a caustic.  
It can burn skin and  
eyes, just like acid.**

**A safe way to demonstrate  
the making of concrete.**

Substitute: 1 part of white glue mixed with 10 parts of water, instead of using cement.

Also try this white glue as a substitute in your other art projects. Instead of using plaster of paris in your casting activities, try using this white glue recipe. It takes a little longer to set but you can now have textures from your molded projects and the glue dries clear.

### Math Challenge

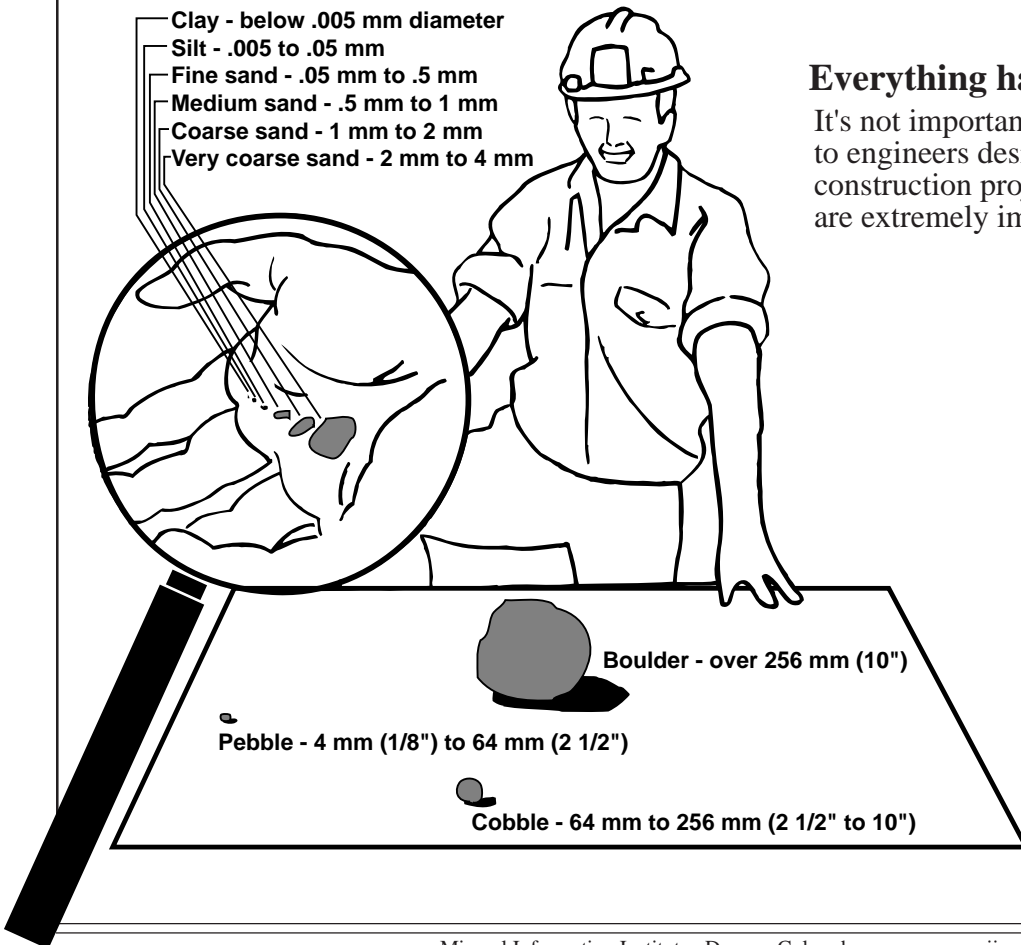
**This sounds too large to be true, but it is.**

Every year 19,000 pounds of sand, gravel, and stone is mined for every person in the United States. These materials are used to make or repair roads and highways, sidewalks, houses, schools, offices, stores, factories, and other buildings that each of us use daily.

For convenience, when converting pounds and tons to cubic yards, assume that one ton of these materials occupies 1 cu. yd. of space.

### Figure out:

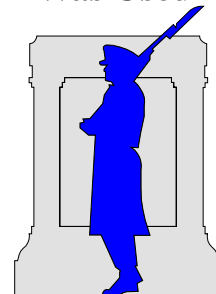
How many pounds of sand, gravel, and stone will be needed by each of your students during their lifetime? How big of a hole needs to be dug somewhere to provide the things they use? For the sidewalk around the school? For the road from their house to school? How many pounds of sand, gravel, and stone are needed by all the students in your class in one year. Compare this (in volume) to the size of your classroom. If your students live to be 75 years old (a good average), how many pounds and cubic yards of sand, gravel, and stone must be mined to support their needs during their lifetime?



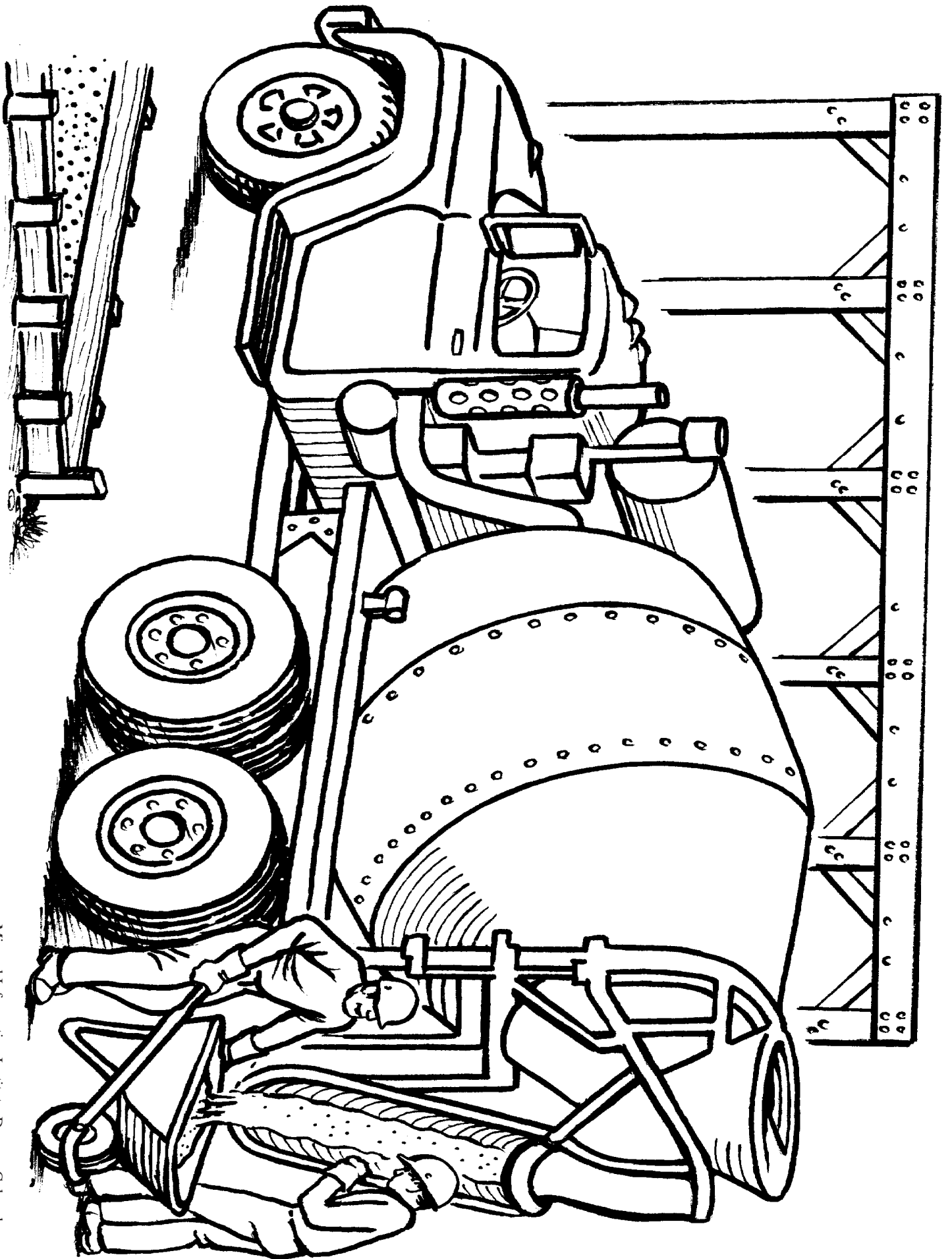
### Everything has a proper name

It's not important to most of us, but to engineers designing special construction projects, proper names are extremely important.

### How One Boulder Was Used



The world's largest single block of marble ever quarried came from Marble, Colorado. The original block weighted 100 tons and now marks the Tomb of the Unknown Soldier in Arlington National Cemetery outside Washington, D.C.





(Please Print or Type the following)

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After you have had a chance to review the enclosed packet items, please return this questionnaire so that we will know if the materials are helping you. Returning this survey also guarantees that you will continue receiving MII's programs and posters.

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Name First Last

School Name

School Address

Phone ( )

My old address was:

Grade Level Subjects taught

Do you teach Full Time Substitute Student Teacher Other: Please specify

Are the materials contained in this packet self explanatory? Yes No Can they be adapted easily to your student's grade level and your teaching style? Yes No Why or Why Not?

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What is your main source for other supplements? Teacher Supply Stores Fellow Teachers Internet Magazines Supply Catalogs Conferences & Workshops Groups Like MII Other

What can MII do to improve its materials; how else may we help you?

Comments About Anything Else:

What are the most important things we can tell our contributors to encourage them to continue to support MII's philosophy of providing free materials to teachers?