

Rural Issues in Energy Contingency Planning

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A critical aspect of energy contingency planning that has not received due consideration concerns the mobility requirements for persons and industries located in small cities and rural areas. The basic activities that provide the necessities for sustaining society are found in these nonmetropolitan settings; for example, livestock raising, crop raising, mining and energy materials extraction, forestry, dairying, and numerous intermediate processing plants. Transportation services provide the vital link between these basic activities and the consumer, and contemporary rural transportation services are powered almost exclusively by gasoline and diesel fuel. Barton (1) analyzed gasoline and diesel fuel consumption in the nation's food and fiber production and distribution system and concludes that the demand for fuel in this system will most likely increase in the future. Furthermore, in his opinion none of the measures suitable for reducing or stabilizing fuel consumption in an emergency situation is expected to substantially reduce fuel demand in the food and fiber production and distribution system.

Another consideration of major importance to small cities and rural areas is preserving personal mobility, at least to the extent that residents can be assured of having a reasonably acceptable quality of life. Rural residents must be able to travel to their place of employment without the trip becoming an overwhelming financial burden. In addition, they should also be able to travel to meet their business, shopping, educational, and medical needs. Rupprecht's (2,3) earlier assessments of this situation emphasized that rural areas usually lack alternative modes of transportation; that is, families are highly dependent on their car or truck. He believes that as energy supplies tighten the "indirect effects on rural development, agricultural production, and the quality of life in rural areas could be considerable."

It is apparent that significant issues still remain to be resolved with respect to energy contingency planning and preserving mobility in rural areas during a petroleum shortfall. Therefore, the objectives of this report are to

1. Provide several insights pertaining to rural population distribution and characteristics of the rural vehicle fleet and rural travel.
2. Identify specific problems that might arise if a petroleum shortfall of sufficient magnitude and duration to affect rural areas were encountered.
3. Suggest a set of institutional arrangements that could provide effective communication links and facilitate implementation of coping measures in rural areas and small cities.

In the discussion that follows data are first presented on the United States, then the focus shifts to the state of Missouri and a six-county rural area served by a council of governments known as the Meramec Regional Planning Commission.

DEMOGRAPHIC CONSIDERATIONS

According to the 1980 census (4), 167,050,992 United States residents live in urban areas, which suggests

that almost 74 percent of the population reside in a metropolitan environment. However, review of the Census Bureau criteria reveals that urban population is defined as all people living in one of the following:

1. Incorporated places of 2,500 or more inhabitants,
2. Census-designated places of 2,500 or more inhabitants, and
3. Other territory, incorporated or unincorporated, included in an urbanized area. An urbanized area comprises an incorporated place and contiguous, densely settled area that together exceed 50,000 inhabitants.

Those living in an urbanized area in 1980 numbered 139,170,680 or 61.4 percent of the population. Other urban locations were reported as having a population of 27,880,309 and rural locations were reported as having a population of 59,443,813. Other urban locations undoubtedly include many small- to medium-sized communities that may not be near a population center or in a Standard Metropolitan Statistical Area (SMSA). It appears likely that the 74 percent urban population statistic overstates the actual proportion of residents living in a true metropolitan environment where transportation planning and energy contingency planning are most likely conducted by qualified personnel.

Another aspect of demographic characteristics deserving further consideration is elderly people because they are especially vulnerable to a serious energy shortfall and escalating fuel prices. In 1980 there were 25,544,133 inhabitants of the United States age 65 and older. This group represents 11.3 percent of the population, and the Census Bureau (5) predicts that this percentage will increase to 13.1 percent by the year 2000 and to 21.7 percent by the year 2050. It is interesting to observe that in eight states the population of elderly people is already in excess of 13 percent. The mobility of these individuals during a fuel shortfall will be highly constrained as gasoline prices increase relative to their fixed income.

The plight of those living at the poverty level will certainly be intensified if fuel becomes scarce or more expensive. The 1980 (6) census revealed that about 29,272,000 persons were within the poverty level criteria, which indicates that 13 percent of the population are in this category. It was also found that 17.5 percent of farm residents fall within the poverty level criteria, and of those persons living outside metropolitan areas 15.4 percent were classified as being below poverty level.

Demographic Characteristics of Missouri

The 1980 population for the state of Missouri (7) was reported as 4,916,686, which represents a modest 5.1 percent increase during a decade. The 1980 Missouri census marked the first time since 1810 that an increase in the percentage of state population classified as rural was identified.

There are 114 counties in Missouri; the city of St. Louis is provided county status by the state constitution. Sixteen of these counties and the

city of St. Louis are located in one of the six SMSAs in the state. Table 1 gives the distribution of Missouri population according to SMSA status and urban versus rural location. These data indicate that the population of Missouri is approximately 32 percent rural and that 35 percent of the population reside outside an SMSA. However, a considerable portion of the urban population is also located outside an SMSA and a substantial number of people live in rural areas located within an SMSA. A more precise evaluation of the rural and urban categorization is given in Table 2. Considering the population located outside urbanized areas, regardless of the inside and outside SMSA classification and the urban and rural classification, it is shown that 2,296,567 persons do not reside in urbanized areas. This constitutes 47 percent of the state population and is substantially higher than the 32 percent previously associated with the rural environment. These inhabitants may be viewed as constituting the rural and small city population of the state.

The data in Table 2 also indicate that there are almost 800 small cities in the state that are not inside urbanized areas. This presents a problem of some magnitude with respect to the communication links that should serve the small cities in the event of a fuel shortfall. It would be unreasonable to expect any state energy office to interact effectively with this large a number of small cities. Problems in effective and timely communications could be expected even if a state energy office had to communicate with as many as 115 separate county-level jurisdictions.

The state of Missouri ranks among the top eight states in the nation in terms of percentage of residents age 65 and older; 13.2 percent of its resi-

dents are in this category (8). The data in Table 3 indicate that of the 648,126 elderly residents in the state, 313,956 are in urbanized areas and 334,170 are in rural locations and small- to medium-sized places under the urban category. The highest concentration of elderly residents is in the rural place category of 1,000 to 2,500 population where 21.2 percent of the population are elderly, followed by the urban small place category of 1,000 to 2,500 population where 18.5 percent of the residents are age 65 and older. A review of census data pertaining to age groups in each county in Missouri revealed that in 27 non-SMSA counties the portion of elderly residents exceeded 20 percent.

According to the 1980 census 559,835 residents of Missouri are below poverty level; 321,250 of these residents are in counties inside an SMSA and 238,585 are in counties outside an SMSA (9). Table 4 gives a tabulation of the percentage of poverty level residents living in the various counties according to whether the county is inside or outside an SMSA. Note that those counties outside an SMSA with less than 10 percent of its residents below poverty level were each adjacent to one of the SMSAs. Those counties outside an SMSA with the higher percentages of population below poverty level tended to be in the more remote rural areas. There are 28 of these rural counties where the poverty level criteria apply to 20 percent or more of the residents.

Demographic Characteristics of the Meramec Region

The Meramec Region is a six-county rural area served by the Meramec Regional Planning Commission (MRPC) in South-Central Missouri. The region is primarily open country with 24 incorporated places in an area of 3,997 square miles. The 1980 population for the region was 105,165, and the largest community in the

Table 1. Population of Missouri according to SMSA status and rural and urban classification.

Location	Inside SMSA-	Outside SMSA	Total
Urban	2,778,059	571,529	3,349,588
Rural	<u>432,408</u>	<u>1,134,690</u>	<u>1,567,098</u>
Total	3,210,467	1,706,219	4,916,686

Table 2. Population and number of places in Missouri.

Location	No. of Places	Population
Inside SMSAs		
Urban		
Inside urbanized areas	149	2,620,119
Outside urbanized areas, places of:		
10,000 to 50,000	3	47,455
5,000 to 10,000	8	54,124
2,500 to 5,000	16	56,361
Rural		
Places of less than 2,500	124	70,572
Other rural, not in places	NA ^a	361,836
Subtotal: Outside urbanized areas	151	590,348
Outside SMSAs		
Urban		
Outside urbanized areas, places of:		
10,000 to 50,000	15	267,493
5,000 to 10,000	21	152,669
2,500 to 5,000	43	151,367
Rural		
Places of less than 2,500	564	320,354
Other rural, not in places	NA ^a	814,336
Subtotal: Outside urbanized areas	643	1,706,219
Total: Outside urbanized areas	794	2,296,567

^aNot applicable.

Table 3. Location of elderly population in Missouri.

Location of Residence	No. of Persons Age 65 and Older	Percent Within Location Age 65 and Older
Urban		
Inside urbanized areas	313,956	12.0
Outside urbanized areas, places of:		
10,000 or more	41,423	13.2
2,500 to 10,000	76,687	18.5
Rural		
Places of 1,000 to 2,500	43,738	21.5
Other rural	172,322	12.7
Statewide	648,126	13.2

Table 4. Percentage distribution of population below poverty level for Missouri counties inside and outside SMSAs.

Range of Population Below Poverty Level (%)	Number of Counties	
	Inside SMSA	Outside SMSA
5.5 to 10.0	2	4
10.1 to 15.0	7	34
15.1 to 20.0	7	32
20.1 to 25.0	1 ^a	19
25.1 to 30.0	0	8
30.1 to 35.0	0	1
Total	17	98
Number of persons below poverty level	321,250	238,585

^aCity of St. Louis is in this range.

region, Rolla, had a population of 13,303. Data for the region given in Table 5 indicate some counties are growing far more rapidly than others; the region population increased by 17.4 percent between 1970 and 1980.

Although a farm, non-town, non-farm, town population stratification is not yet available for 1980, it is apparent that through 1970 the region has experienced a dramatic loss in farm population accompanied by a strong increase in non-town, non-farm population, and a gradual increase in town population. From 1950 through 1970 the non-town, non-farm population increased by 170 percent.

An analysis by Dare (10) reported elsewhere documented the population shifts occurring from 1970 to 1980 at the township level for Phelps County, the most populous county of the region. In the 10-year period ending in 1980 the cities in Phelps County experienced a growth of only 1.2 percent. During the same time the population of townships adjacent to cities increased by 37.3 percent. This indicates that there may be a tendency for small cities to sprawl, with very low density rural subdivision developments and scattered dwelling units occupying territory in a range of 1 to 4 miles from the city limits. The implications of this type of rural residential development are not especially desirable with respect to the impact of a severe fuel shortfall, the inability of public transportation to serve such areas, and the adverse effect of widespread origins on the potential for ridesharing.

RURAL VEHICLE FLEET CHARACTERISTICS

The 1977 Nationwide Personal Transportation Study (NPTS) (11) verified that cars owned by residents living outside an SMSA were older automobiles that had lower miles-per-gallon performance than cars owned by residents living inside an SMSA. Furthermore, automobiles owned by those households in the lower income brackets follow the same tendencies,

Table 5. Meramec Region population trends.

County	Year	Population			
		Farm	Non-Town, Non-Farm	Town	Total
Crawford	1950	5,703	2,235	3,677	11,615
	1960	2,814	5,340	4,493	12,647
	1970	1,914	7,138	5,776	14,828
	1980				18,300
Dent	1950	5,827	1,498	3,611	10,936
	1960	2,838	3,737	3,870	10,445
	1970	1,794	5,091	4,572	11,457
	1980				14,517
Gasconade	1950	4,923	1,361	6,058	12,342
	1960	3,368	2,405	6,422	12,195
	1970	2,454	2,955	6,469	11,878
	1980				13,181
Maries	1950	5,299	747	1,377	7,423
	1960	3,063	2,667	1,552	7,282
	1970	2,288	3,016	1,547	6,851
	1980				7,551
Phelps	1950	6,062	2,992	12,450	21,504
	1960	2,975	7,146	15,275	25,396
	1970	1,975	9,879	17,627	29,481
	1980				33,633
Washington	1950	5,621	5,819	3,249	14,689
	1960	2,297	8,458	3,591	14,346
	1970	1,531	9,993	3,562	15,086
	1980				17,983
Region total	1950	33,435	14,652	30,442	78,509
	1960	17,355	29,753	35,203	82,311
	1970	11,956	39,553	38,072	89,581
	1980				105,165

with lower income levels having the least fuel-efficient cars.

Pickup Trucks

The 1977 NPTS (11) also indicated that the personal vehicle fleet was comprised of 14.1 percent pickup trucks, pickups with a camper, or other trucks. The highest ownership rate for personal trucks was in the non-SMSA lower population category. For those households owning one vehicle 14.7 percent were pickups or trucks and for households owning more than one vehicle 28.4 percent were pickups or trucks.

A more recent tabulation of personal truck ownership is published in the 1981 edition of Highway Statistics (12). The Federal Highway Administration uses a "light" truck classification that includes pickups, panels, and vans of 10,000 lb or less gross vehicle weight. The data given in Table 6 show the importance of light truck registrations for representative states throughout the nation. Clearly the highly urbanized states such as Connecticut, New York, and Maryland have low percentages of light truck registrations whereas those states with extensive rural areas such as Montana, Arkansas, and Oklahoma have light truck registrations accounting for 30 percent of the private vehicle fleet. States such as California, Florida, and Missouri have light truck registrations approximating the national average, which is 17.4 percent.

A more exact determination of the extent to which trucks are owned in rural areas in Missouri and in small cities is provided by the Division of Planning, Missouri Highway and Transportation Department (Table 7). These data pertain to the six counties of the Meramec Region. Motor vehicle registrations in the Meramec Region increased by a factor of 3 in the 30 years from 1951 through 1981. During this time the percentage of registrations accounted for by trucks (note: vans are commonly registered as cars in Missouri) and recreation vehicles increased from 30 percent to 36 percent. Interestingly those counties with the least population in small cities, such as Maries County, had truck ownership rates as high as 40 percent.

It is important to recognize the pickup as a useful family commuting and utility vehicle that serves not only the trip to work but also hauls many types of supplies, materials, and firewood for rural residents. The 1977 NPTS (13) indicated 47.6 percent of the vehicle miles traveled by pickups and other trucks was for the purpose of earning a living and 22.0 percent of the vehicle miles were for family and personal business.

The pickup truck, as well as other heavier trucks, have the disadvantage of lower fuel efficiency. Oak Ridge National Laboratory (14) estimates

Table 6. Registration of light trucks in selected states (1981).

State	Total Private and Commercial Vehicles Registered	Light Trucks Registered	Percent Represented by Light Trucks
Arkansas	1,639,972	479,156	29.2
California	16,512,263	2,656,679	16.1
Connecticut	2,079,437	107,802	5.2
Florida	7,785,781	1,119,574	14.4
Iowa	2,313,710	516,750	22.3
Maryland	2,822,449	319,659	11.3
Missouri	3,307,248	650,390	19.7
Montana	723,180	236,247	32.7
New York	8,003,967	756,040	9.4
Oklahoma	2,568,590	773,589	30.1
South Dakota	599,011	181,198	30.2
Texas	10,864,595	2,772,187	25.5

Table 7. Vehicle registration in Meramec Region Counties (1951-1981).

County	Year	Percent of Registrations			Total Motor Vehicles Registered
		Passenger Cars	Full Fee Trucks and Recreational Vehicles	Prorate Trucks and Buses	
Crawford	1951	64.28	35.65	0.07	4,093
	1981	61.53	37.98	0.49	11,814
Dent	1951	66.80	33.04	0.16	3,744
	1981	60.29	38.72	0.99	10,970
Gasconade	1951	75.40	24.46	0.14	4,387
	1981	62.20	37.17	0.63	10,681
Maries	1951	70.10	29.39	0.51	2,147
	1981	58.91	40.63	0.46	4,086
Phelps	1951	73.78	25.78	0.46	7,094
	1981	67.95	31.65	0.40	22,945
Washington	1951	63.28	36.34	0.38	3,965
	1981	61.48	38.02	0.50	12,025
Total for Meramec Region	1951	69.56	30.16	0.28	25,430
	1981	63.32	36.13	0.55	75,521

the automobile fleet sold in the United States in 1980 to have a fuel efficiency of 23.1 miles per gallon as compared to a fuel efficiency of 17.5 miles per gallon for light trucks. Light trucks have shown a higher survival rate than automobiles, with half of all light trucks sold still in operation after 14.5 years.

RURAL TRAVEL

Nationwide travel characteristics reported by the 1977 NPTS (15) indicate that approximately 70.3 percent of all vehicle trips and 63.2 percent of all vehicle miles of travel are made by urban residents. However, the NPTS data were stratified according to the Bureau of the Census definitions for urban, urbanized area, and urban place. The statistics when cited for urban versus rural characteristics therefore include under the urban category those incorporated and unincorporated places with populations as low as 2,500 persons. As previously stated in this paper there are many places in the population range of 5,000 to 50,000 persons that are in relatively remote areas and their transportation facilities, services, and population densities are different from metropolitan areas.

Table 8 gives the percentage distribution of trips and of vehicles miles traveled according to the rural versus urban category of residence, as well as population subgroups identifying the size of urban place which was the traveler's residence. If the urban population group comprised of small cities

Table 8. Nationwide trips and vehicle miles traveled by private modes according to place of residence (1977).

Place of Residence	Trips (%)	Vehicle Miles Traveled (%)
Urban areas		
Population group:		
1,000,000 and above	31.0	30.8
200,000 to 1,000,000	16.9	14.8
50,000 to 200,000	9.8	7.4
5,000 to 50,000	12.6	10.2
Rural areas	29.7	36.8
Rural areas combined with small cities	42.3	47.0

ranging from 5,000 to 50,000 persons is combined with the data for rural area residents, then it could be concluded that small city and rural residents generate 42.3 percent of the personal trips. Similarly, if the data for vehicle miles traveled are combined for small cities and rural areas, then it appears that small city and rural residents generate 47.0 percent of the vehicle miles traveled. These statements must be viewed with some reservation because there are numerous small cities that are indeed a portion of an urbanized area. Yet the 29.7 percent of trips and 36.8 percent of vehicle miles traveled do not fairly represent the amount of travel taking place outside metropolitan regions.

The 1977 NPTS also reported the location of travel according to place of residence of the traveler, as given in Table 9. It can be seen that 40.5 percent of the vehicle miles traveled are in rural areas. An additional 4.24 percent of the vehicle miles traveled were accounted for by residents of small cities traveling in their home-urban area.

Households, Trip Rates, Trip Lengths

NPTS (16) findings also indicated that generally residents of households located outside SMSAs travel slightly more than those inside SMSAs. As the data in Table 10 indicate, residents of households outside SMSAs travel 12,551 miles annually on the basis of 1,465 annual trips compared to 11,745 miles traveled annually on the basis of 1,432 trips for residents of households inside SMSAs. The highest trip rate, all categories considered, is for residents of households inside an SMSA, but not in the central city. The longest average trip length is

Table 9. Percent distribution of vehicle miles traveled nationwide according to place of residence (1977).

Place of Residence (Population)	Location of Travel			Total
	Home Urban Areas	Other Urban Areas	Rural Areas	
Urban areas				
Population group:				
1,000,000 and above	26.94	1.06	2.79	30.8
200,000 to 1,000,000	11.52	0.68	2.59	14.8
50,000 to 200,000	4.90	0.54	1.98	7.4
5,000 to 50,000	4.24	1.06	4.90	10.2
Rural	NA ^a	8.57	28.23	36.8
Total	47.6	11.9	40.5	100.0

Note: Totals are rounded to nearest tenth.

^aNot applicable.

Table 10. Household trip rates, vehicle miles, and average trip length by household location (1977).

Household Location	Distribution of Households (%)	Annual Trip Rate per Household	Annual Vehicle Miles per Household	Average Trip Length (miles)
Inside SMSA				
Within central city	34.9	1,257	9,311	7.4
Not in central city	32.4	1,621	14,449	8.9
Average		1,432	11,745	8.2
Outside SMSA				
Under 5,000	16.7	1,409	13,837	9.8
More than 5,000	16.0	1,524	11,208	7.3
Average		1,465	12,551	8.5
All households	100.0	1,443	12,035	8.5

9.8 miles for residents of households outside SMSAs in the under 5,000 population group.

Trip Lengths and Mode

Data on the home-to-work trip from the 1977 NPTS (17) are summarized in Table 11. The data apply to an estimated work force of 85,060,000 less 5,846,000 workers not reporting distance or time and those who did not work in a fixed place. The average trip length statistics in Table 11 also exclude 3,416,000 workers who worked at home. Almost 32 percent of the work force is located outside SMSAs, and these workers have a longer average travel distance than workers inside SMSAs. In addition, only 0.5 percent of the work trips made by workers not residing in SMSAs were made by public transportation.

A detailed analysis of work trips in Missouri, the six-county Meramec Region, and Maries County is given in Table 12. These data are from the 1980 census (18) and show, in addition to the mode of travel, the extent of ridesharing in carpools. Carpooling was extensive throughout the state in 1980, with 21.8 percent of workers carpooling. However, in the rural six-county Meramec Region, 27.0 percent of the workers carpool and in Maries County the number of workers carpooling was as high as 35.5 percent. Further examination of the census data for Maries County reveal that for residents who reported location of work, 47.8 percent work outside the county. A reasonable explanation for this continued high level of carpooling in rural areas is that workers are sharing rides as much as possible to help reduce the costs of traveling to work.

Table 11. Work force trip length and mode by location of residence (1977).

Residence Location	Distribution of Workers (%)	Work Trip Length (miles)	Percent of Home-to-Work Trips by Mode		
			Private Vehicle	Public Transportation	Bicycle, Walking
Inside SMSA					
Within central city	33.0	7.8	84.5	9.5	6.0
Not in central city	35.3	11.0	91.6	3.5	4.9
Average		9.5	88.4	6.2	5.4
Outside SMSA					
Under 5,000	16.1	11.8	93.9	0.2	5.9
More than 5,000	15.6	8.1	93.9	0.6	6.1
Average		9.9	93.5	0.5	6.0
All workers	100.0	9.6	89.9	4.5	5.6

Table 12. Commuting to work in Missouri by mode of transportation.

Mode	Percent Distribution		
	State of Missouri	Six-County Meramec Region	Maries County
Car, truck, or van			
Drive alone	65.3	60.5	47.9
Carpool	21.8	27.0	35.5
Public transportation	3.8	0.6	0.7
Walked only	4.6	5.6	7.1
Other means	1.0	1.5	1.6
Worked at home	3.5	4.8	7.2
Total (%)	100.0	100.0	100.0
Total workers over 16 years of age	2,078,854	37,866	2,861

IMPORTANCE OF RURAL INDUSTRIES

The objective of this section is to briefly highlight the importance of rural industries. Rural industries provide the basic necessities on which society depends and the basic materials which support national production capability. No attempt will be made to quantify the specific fuel or transportation needs of rural industries, as the overall requirements for employees, raw materials, partially processed goods, and finished products are rather complex.

Agriculture

In 1981 approximately 5.8 million persons in the United States lived on farms and another 2.4 million persons did some hired farmwork (19). Nationally, there were almost 2.5 million farms in 1981 and they accounted for 1.04 billion acres of land. U.S. farm families earned a total income of \$64 billion in 1981 with more than half of this sum coming from off-farm sources.

World production of grains in 1982-1983 was forecast at 1.5 billion metric tons with the United States predicted to produce more than 22 percent of that total. The inventory of all cattle and calves on U.S. farms and ranches was 115.7 million at the beginning of 1982. Nationwide the supply of milk and dairy products rose to 153.4 billion pounds in 1982.

In the state of Missouri, agriculture is a more highly developed industry than is generally realized; cash receipts from sales of crops and livestock totaled more than \$4.1 billion in 1981 (20). The Missouri Department of Agriculture estimates that one of every five workers in the state is involved in some phase of agriculture, including those directly involved in farming and others involved in processing, transportation, or merchandising of food and fiber.

Forestry

Commercial timberland was estimated to cover more than 482 million acres in the United States in 1977 (21). Total commercial timberland is expected to gradually decrease during the next several decades because of reductions in national forest holdings and because less area is being devoted to timber on farms. Forest industry acreages are expected to consistently increase in the future, reaching 73 million acres by the year 2020.

In Missouri removal of timber amounted to 167.7 million cubic feet in 1972; this quantity is expected to increase steadily through the end of the century (22). Commercial forest covers more than 28 percent of the land in Missouri, with some counties reporting forest acreage as high as 78 percent. Forestry products include saw logs, cooperage logs, charcoal wood, pulpwood, veneer logs, posts, and other miscellaneous industrial products.

An interesting occurrence during the past several years is the increasing use of wood for home fuel (23). It is estimated that 690,700 Missouri households burned wood during 1982 and that in 38 percent of these households wood was the major heat source. It was also found that the use of firewood as the primary or supplementary heat source occurs about three times more frequently in rural counties as compared with urban counties. For those cutting their own wood, the average travel distance was about 7.5 miles for rural residents and almost 30 miles for urban residents.

Mineral Production

Mineral extraction, processing, and refinement is a vast industry in the United States; the estimated value of nonfuel mineral production was \$25.2 billion in 1981 (24). In 1981 the nonfuel mineral production in Missouri amounted to \$870.3 million. This was a substantial decrease compared with the previous 2 years and reflects significant reductions in the demand for cement, lead, and copper throughout the United States.

In Missouri the level of employment reported for the mining industry was 8,338 in 1980 (25). This is only a small fraction of the statewide work force which was on the order of 1,670,000 employees in 1980. Despite the small number of employees directly involved in mining, it would appear to be especially important to assure their work trip needs will be satisfactorily met during a fuel shortfall.

RURAL TRANSPORTATION SURVEYS

A recent study conducted by Dare (26) in cooperation with the Meramec Regional Planning Commission (MRPC) involved two communitywide attitude surveys, an areawide telephone interview, and a mailout questionnaire to local government officials in small cities and rural counties. Also, the results of nine other small city surveys were made available during the MRPC study which contained information about fuel conservation strategies and rural travel habits. Because these studies are well documented in a report made available through the U.S. Department of Transportation Technology Sharing Reprint Series (26), only two of the most pertinent studies are discussed here.

1977 Regional Rural Resident Survey

The Office of Rural Development, University of Missouri-Columbia, conducted a survey of 3,391 open-country rural residents between August and November 1977. These home interviews were conducted in Crawford, Dent, Gasconade, Maries, and Washington counties, the least populated counties in the Meramec Region. One of the most significant findings was the average trip length for various purposes reported by open-country rural residents (Table 13). This survey indicated an average one-way distance to work of 29 miles and 26 miles for the head of the household and spouse, respectively. These distances are about 2.2 to 3.6 times greater than the values reported on the 1977 NPTS for work trips of residents outside SMSAs.

Trips for general medical care averaged 22 miles, whereas an average trip for specialized medical care averaged 54 miles one-way. Rural residents seeking specialized medical care often must travel across several counties to reach their destination because

Table 13. Distance traveled one-way by open-country rural residents in the Meramec Region (1977).

Trip Purpose	Average One-Way Travel Distance in Miles
Work, head of household	29
Work, spouse	26
Grocery shopping	11
Banking	11
Recreation	11
School	8
Religious services	6
General medical care	22
Specialized medical care	54

there are 36 rural counties in Missouri without a registered hospital. It appears likely that the average trip distance statistics from the NPTS do not accurately represent the travel distances encountered by the open-country rural residents in Missouri.

Survey of Local Government Officials

In order to gain insights from the perspective of the rural community concerning fuel conservation measures already in use and strategies that might be suitable during a fuel shortfall, a survey of local government officials was conducted during summer 1981. The survey was delivered to local government officials in 24 cities in the Meramec Region, 31 other Missouri communities with a population range of 600 to 33,000, and a large military base (with 2,100 civilian employees) adjacent to the Meramec Region. Altogether 25 surveys were returned, 16 from within the region and 9 from outside the region. The survey questions were divided into the following categories: commuter parking lots, carpooling, bicycle routes, sidewalks, traffic engineering, transportation energy contingency planning, and provision of city services. The more significant findings of this survey are given in Tables 14 through 18.

As the data in Table 14 indicate, one ridesharing activity already implemented in small communities is the commuter parking lot, with 9 of 25 local government officials indicating the presence of this type of facility. These lots serve as a convenient rendezvous point where carpool and vanpool members converge, leave some of their vehicles, and continue their trip together. Further investigation of this activity revealed that most of these lots were constructed by the Missouri Highway and Transportation Department (MHTD) under a 1973 program. Statewide, MHTD has provided at least 74 of these lots with a total parking capacity of about 4,000 spaces. One small community took the initiative by constructing its own commuter parking lot in a convenient location adjacent to an automobile dealer. Seventeen officials indicated that in their community existing local parking lots could be used for commuter parking if the necessity developed.

As the data in Table 15 indicate only one responding community was involved in a citywide carpool program. This happened to be the carpool matching service at the Civilian Personnel Office, Fort Leonard Wood, Missouri, which estimated that 75 percent of the civilian work force used carpools. Undoubtedly, this service would be more appropriately described as an employer-based carpool coordinator. A worthwhile result from the survey is that a majority of the local government officials believed a large map on a display board would be helpful if they were to coordinate a manual carpool service in the city.

It is evident from Table 16 that smaller cities have not been highly concerned with developing bicycle paths. The only positive responses came from cities with about 2,600 inhabitants each. Many of the smaller communities indicated that there would be little problem riding a bicycle to any destination within the city. When asked about the safety aspects of bicycle riding, most respondents believed their streets would provide a safe thoroughfare. Several respondents qualified their answers, indicating certain streets and intersections would have to be avoided. Others felt that bicycling would be impractical because of steep hills in the community.

The lack of convenient access to engineering expertise is a problem that is known to exist in

Table 14. Responses of local government officials to selected commuter parking questions.

Question	Response	Location of City		Total
		Inside Meramec Region	Outside Meramec Region	
(1) Does your community currently have a commuter parking lot?	Yes	6	3	9
	No	<u>10</u>	<u>6</u>	<u>16</u>
	Total	16	9	25
(6) In an emergency fuel shortage, rather than wait for new commuter parking to be constructed, would there be existing private or public parking that could be used for commuting purposes?	Yes	13	4	17
	No	1	2	3
	No reply	<u>2</u>	<u>3</u>	<u>5</u>
	Total	16	9	25

Table 15. Responses of local government officials to selected carpooling questions.

Question	Response	Location of City		Total
		Inside Meramec Region	Outside Meramec Region	
(1) Is your community involved in a citywide carpool program?	Yes	0	1	1
	No	<u>16</u>	<u>8</u>	<u>24</u>
	Total	16	9	25
(4) A helpful device in carpooling might be a reasonably large display board showing a map of the area. This display board could be used to match trip destination and desired times of travel. Do you believe this would be a beneficial device in your community if you had a manual carpool coordination system?	Yes	11	5	16
	No	4	3	7
	No reply	<u>1</u>	<u>1</u>	<u>2</u>
	Total	16	9	25

Table 16. Responses of local government officials to selected bicycle route questions.

Question	Response	Location of City		Total
		Inside Meramec Region	Outside Meramec Region	
(1) Does your community currently have a program of bicycle route development?	Yes	1	1	2
	No	<u>15</u>	<u>8</u>	<u>23</u>
	Total	16	9	25
(2) If many people desired to ride a bicycle to the downtown and/or other activity centers in your town, would the street conditions be adequate to provide them a safe thoroughfare?	Yes	11	5	16
	No	<u>5</u>	<u>4</u>	<u>9</u>
	Total	16	9	25

Table 17. Responses of local government officials to selected traffic engineering questions.

Question	Response	Location of City		Total
		Inside Meramec Region	Outside Meramec Region	
(3) Do you believe your community is adequately advised with respect to traffic engineering practice and traffic engineering improvements?	Yes	10	6	16
	No	5	3	8
	No reply	<u>1</u>	<u>0</u>	<u>1</u>
	Total	16	9	25
(5) Would you favor having a professional engineer staff member in the regional planning office who would perform traffic engineering and planning services for small cities and counties on a rotating basis?	Yes	8	6	14
	No	5	1	6
	No reply	<u>3</u>	<u>2</u>	<u>5</u>
	Total	16	9	25

many rural areas. This is an especially critical issue in Missouri because few rural county and city government units have trained professional engineers on their staff. As the data in Table 17 indicate, the majority of survey respondents did not feel they were being adequately advised with respect to traffic engineering practice and improvements. Local government officials responding to the survey expressed a strong preference for having traffic engineering services available on a rotating basis through the regional planning commission staff. Some of those replying negatively to this question were from small communities where there were no traffic problems. Negative responses came from larger com-

munities which occasionally used a consulting firm for traffic engineering services.

As expected, the responding officials indicated that virtually no effort had been made to develop formal transportation energy contingency plans. The one positive response given in Table 18 was received from the facilities engineer at Fort Leonard Wood. Most cities in the population range receiving the questionnaire could not reasonably have been expected to have the personnel available to prepare an energy contingency plan. Nevertheless, it is interesting to review some of the fuel conservation measures that were taken in these communities. Those measures included: establishing an energy advisory

Table 18. Responses of local government officials to selected transportation contingency plan questions.

Question	Response	Location of City		Total
		Inside Meramec Region	Outside Meramec Region	
(1) Does your community now have a transportation fuels contingency plan outlining actions to be taken in the event of a severe gasoline shortage?	Yes	0	1	1
	No	16	8	24
	No reply	0	0	0
	Total	16	9	25
(2) In the event of a severe gasoline shortage, which levels of government do you believe would be most efficient for you to communicate with regarding gasoline conservation programs?	State Energy Office	2	5	7
	Regional Planning Commission	11	2	13
	County Energy Office	1	0	1
	Other	0	1	1
	No reply	2	1	3
	Total	16	9	25

committee, sectionalized maintenance of streets, purchasing fuel-efficient cars, removing unwarranted STOP signs or replacing them with YIELD signs, specifying limits on fuel consumed in the provision of certain services as law enforcement, and placing traffic signals on flashing amber/red during late-night to early-morning hours.

Also given in Table 18 is an important indication with respect to preferred communication links that might be activated in the event of a fuel shortage. The respondents indicated a strong preference for having the regional planning commission serve as a focal point between them and the state energy office. The responses received from officials within the Meramec Region were highly in favor of this concept, with 11 of the 14 officials who expressed an opinion favoring the MRPC. Undoubtedly, this is a reflection of the high degree of success the MRPC has achieved in its role as an advisor and intermediary in dealing with state and federal programs and providing services for its member cities and counties.

INSTITUTIONAL ARRANGEMENTS: RURAL AREAS

In a recent report Carlson (27) reviews the actions taken by federal, state, and local agencies in responding to the 1979 fuel shortfall. Although Carlson's work does not focus on institutional arrangements and the problems of rural areas, it nevertheless highlights the necessity for effective leadership at the local level and the importance of consistent, coordinated, and meaningful communications to the local lead agency. Carlson states that the natural choice for the leadership role in local and regional conservation and contingency planning programs should be the metropolitan planning organization (MPO). However, MPOs would encounter several difficulties in assuming that leadership role. Examples of these problems include lack of experience in planning services, no leverage to involve new actors into efforts to respond to new problems, and inability to offer incentives for implementing programs that might modify or constrain an existing activity. Carlson's observations concerning MPOs would probably apply to the institutional arrangements about to be suggested for rural Missouri; however, these concepts need to be presented to serve as a basis for further consideration and refinement.

THE REGIONAL PLANNING COMMISSION

For all practical purposes, the only organizational structure located in rural Missouri that has established a credible record in serving small cities and rural counties by fostering regional cooperation and

mobilizing locally available talent for the general betterment of a large geographical area is the regional planning commission (RPC).

The 20 RPCs in Missouri today are the result of state legislation passed in 1966 entitled the State and Regional Planning and Community Development Act. RPCs are voluntary associations that consist primarily of elected officials from the cities and counties within the region. Commission membership may be extended to individuals representing specific sectors of the region such as the elderly, minorities, labor, housing, transportation services, and economic development. The RPCs provide advisory services, perform research on regional and local problems, and act as a liaison with state and federal agencies and with private businesses according to the direction given by the Board of Commissioners. The size of the staff varies from about 7 up to 25 employees for RPCs serving rural areas, whereas the metropolitan area planning organizations in Missouri may employ from 10 to as many as 175 staff members (28).

The responsibilities of the RPC include preparing a comprehensive plan for the region; providing recommendations for transportation facility development, land use, and land development; and projecting the extent of utility requirements. RPCs are also empowered to conduct research studies, collect and analyze data, and coordinate programs that relate to regional objectives.

Table 19 gives the 20 RPCs in Missouri and provides information about their population and size. The RPCs located in SMSAs are the East-West Gateway, Mid-America, Mid-Missouri, Mo-Kan, Ozark Gateway, and Southwest Missouri. The 14 rural RPCs differ considerably by the size of their service area, population, and number of counties. Some of the rural RPCs are larger in certain respects than their counterparts serving SMSAs. For instance, the Boot-heel RPC and the Southeast Missouri RPC both serve populations greater than the Ozark Gateway. The land area covered by the South Central Ozark RPC, the Green Hills RPC, and the Kaysinger Basin RPC exceed that covered by most of the urban RPCs.

MERAMEC REGIONAL PLANNING COMMISSION

Located in south-central Missouri, the MRPC provides an excellent example of a successful RPC working in the rural environment. In 1980 the MRPC service area contained 105,073 inhabitants distributed over an area of approximately 4,000 square miles. The Board of Commissioners consists of 35 members, 27 of which are elected officials from city and county government. Other commissioners currently represent the elderly, the unemployed, education, labor, small

Table 19. Regional planning commissions serving Missouri.

Region	Area (miles ²)	Population (1980)	No. of Counties in Region
Boonslick	1,590	48,464	3
Bootheel	3,418	159,203	6
East-West Gateway			
Missouri	2,713	1,789,402	4
Illinois	1,788	518,605	3
Green Hills	4,933	89,081	9
Kaysinger Basin	4,753	94,459	7
Lake of the Ozarks	3,175	118,461	5
Mark Twain	4,569	125,297	8
Meramec	3,998	105,073	6
Mid-America			
Missouri	2,713	884,416	5
Kansas	1,087	490,320	3
Mid-Missouri	4,661	264,473	8
Missouri Valley	2,212	47,486	3
MO-Kan			
Missouri	1,683	126,006	4
Kansas	802	26,580	2
Northeast Missouri	2,342	49,102	5
Northwest Missouri	2,645	48,669	5
Ozark Foothills	3,424	74,081	5
Ozark Gateway	2,405	153,481	4
Show-Me	2,139	105,390	3
South Central Ozark	6,122	103,689	7
Southeast Missouri	3,672	165,425	7
Southwest Missouri	6,011	355,457	10

business, minorities, industry, and agriculture. The MRPC maintains a Housing Advisory Board, a Regional Manpower Advisory Council, and the Central Ozark Development Council, which manages loans for small businesses. Among the activities and services offered by the MRPC are the following:

1. Publish and distribute a technical assistance bulletin.
2. Prepare urban development action grant applications.
3. Manage county road signing program.
4. Conduct energy audits of government buildings.
5. Prepare comprehensive plans for member cities.
6. Implement joint purchasing agreements.
7. Provide local auditing assistance.
8. Manage U.S. Department of Housing and Urban Development (HUD) Section 8 housing program.
9. Coordinate on-the-job training for the Missouri private industry council.
10. Introduce city manager circuit rider program.
11. Coordinate regional airport study.
12. Survey freight transportation needs along a railroad corridor scheduled for abandonment.
13. Conduct Section 18 public transportation study.
14. Prepare community development block grant applications.

Furthermore, the MRPC was actively involved with the University of Missouri-Rolla in the study leading to the report Transportation Energy Contingency Plans for Rural Areas and Small Communities (26). MRPC staff are extremely familiar with the resources, the problems, and the needs of the region. It is clear, however, that the MRPC does not at this time employ staff who are trained in the more technical aspects of transportation engineering and planning of transportation systems. Considering the importance of transportation to the economic well-being of the region, it would seem highly desirable for the MRPC, perhaps in cooperation with a neighboring region, to

seriously consider acquiring a staff member with formal training in transportation.

The potential for an agency such as the MRPC to function as a coordinator of energy conservation programs is readily apparent. The major issue appears to be whether it can afford the personnel with the training to effectively carry out the programs. There is undoubtedly a significant need for engineering expertise at this level of government in the rural environment.

The County Energy Coordinator

Each county in Missouri has an official designated as an emergency preparedness director and one designated as an emergency preparedness coordinator. These individuals are part of a statewide network established and continually updated by the Disaster Planning and Operations Office in the Missouri Department of Public Safety. In Phelps County the duties of the emergency preparedness coordinator are performed by the deputy sheriff.

The emergency preparedness coordinator for Phelps County also appoints a county energy officer as requested by the governor's office in March 1978. The Phelps County energy officer maintains an inventory of auxiliary power generation equipment, has identified installations that may have transportation problems in the event of a fuel shortage, and maintains a list of organizations that could provide volunteer and medical assistance. Concern for potential problems associated with gasoline availability during late 1979 prompted the Phelps County energy officer to prepare an inventory of fuel distributors and retail outlets. The information in this inventory included:

1. Types of fuels usually available.
2. Days and hours the facility is open for business.
3. Whether or not the facility would open after hours to provide emergency service.
4. Availability of emergency equipment.
5. Names and phone numbers of those responsible for facility operation.

The purpose of compiling this inventory was to be prepared to aid motorists traveling through the county who might become stranded without any fuel. Locating such an activity in the sheriff's office appears to offer some noteworthy advantages. In particular, the office is open continuously and can always be contacted during an emergency regardless of the time. For those seeking information about fuel, the sheriff's office is a logical contact point at the county level. Furthermore, the office is linked to a statewide communications network and any unusual circumstances requiring additional fuel supplies could be quickly made known at the state level by using the emergency preparedness communications network.

The Cooperative Extension Service

The University of Missouri Cooperative Extension Service is organized according to boundaries comparable to those of the RPCs. In each region there is an area headquarters and subsidiary county offices where appropriate extension specialists are assigned. Extension programs and services traditionally have been oriented toward agricultural problems, home economics training, youth services, and business development. In addition, there are

several community development and local government specialists whose duties are to assist local individuals and groups in effectively dealing with issues that concern their community. The area and county extension offices also have access to the faculty at the University of Missouri to assist them in educational programs and problem solving.

In response to the 1979 shortfall, the Meramec Area Extension Service in Phelps County sponsored a short course on rural road and street maintenance and a seminar on ethanol production. Special arrangements were made to have a large mobile training center housed in a van tour the cities in the area to present demonstrations and videotapes on energy conservation. Preceded by significant publicity, the van would be parked at a shopping center, a large grocery store, at the center of town, or some other conspicuous location. The vehicle was essentially a self-contained classroom, with an expandable exterior stage mounted on one side. Visitors were able to walk through the van at their leisure and scheduled shows or demonstrations were provided outside the vehicle. A vehicle equipped such as this one could be extremely valuable in transmitting ideas on fuel-saving, driving techniques, trip planning, improved vehicle maintenance, and ridesharing to large numbers of small community and rural area residents.

CONCLUSIONS

The primary objective of this report is to identify unresolved problems concerning transportation energy contingency planning for rural areas. Data presented in this report have described the extent of vulnerability of the populations living outside metropolitan areas. In Missouri there are more elderly persons living in rural areas and small cities than there are in urbanized areas. There is a slightly higher number of individuals existing under poverty level conditions inside SMSA counties as compared with non-SMSA counties. However, there are 28 counties in rural Missouri where 20 percent or more of the residents are beneath poverty level standards.

The vehicle fleet in rural areas consists of older, less fuel-efficient vehicles and there is a substantially higher proportion of trucks. Rural residents have almost no alternative transportation modes to rely on. They must either share rides, reduce miles traveled, or improve the fuel efficiency of their vehicle. Based on information concerning work-trip characteristics in Missouri, extensive carpooling continues to occur in rural areas to a far greater extent than is occurring in urban areas. Because of this, it is possible that little additional ridesharing could be achieved in rural areas during a fuel shortage.

When evaluating rural travel statistics great care must be taken when interpreting values. A study of several truly rural counties with large sample sizes has revealed trip distances for open-country rural residents far exceeding the nationwide average values.

One of the more critical sectors of the rural population is the farm family. The costs of agricultural production would undoubtedly escalate during a fuel shortfall, and farmers would have to make significantly larger cash outlays just to be able to plant crops and acquire livestock. This would leave the farm family with a reduced share of their budget for allocation toward the purchase of gasoline that would have become more expensive. It must be remembered that about 50 percent of farm family income is

earned from the farm, which necessitates the purchase of fuel for work trips.

A definite problem exists in rural areas concerning agencies that might be qualified to assume a leadership role in contending with a fuel shortfall. The RPC seems to be the logical choice for this role in rural Missouri, yet typically no individuals on their staff have expertise in transportation. Perhaps working arrangements could be established with the state energy office, university faculty, or consultants to fill this void.

Considering that industries responsible for providing the nation's basic food supplies as well as the raw materials for construction and manufacturing activities are located in rural areas, it appears that far too little emphasis has been placed on rural transportation energy contingency planning. This report is designed to stimulate others to devote more of their resources and skills to solving the mobility problems of rural residents. It is also designed to encourage others to devote more resources and skills to alleviating the hardships rural residents would encounter if future events generated a shortage of transportation energy.

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