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Riding the Rails: Light-Rail Transit Market Areas in the Twin Cities

by Francis E. Loetterle

The term *rail transit* encompasses many types of mass transportation, including the underground subway systems in New York or London, the commuter-rail lines in Chicago or on Long Island, and the streetcar systems found in Toronto and Philadelphia (and, at one time, in the Twin Cities). Unless you ride the historic trolleys at Lake Harriet or in Excelsior, you would have to leave the Twin Cities metropolitan area to experience rail transit firsthand. Within three years, however, that will change. The Minnesota Department of Transportation (MnDOT) and the Metropolitan Council have begun construction of a *light-rail transit (LRT)* line from downtown Minneapolis to the Minneapolis/St. Paul International Airport and the Mall of America, and preliminary engineering plans have begun for a commuter-rail line from downtown Minneapolis to St. Cloud. Both of these lines are expected to open by fall 2003.

In the late 1980s and early 1990s, planning for LRT in the Twin Cities had reached a high-water mark. During that period, I joined a local planning and engineering consulting firm, and was involved in the regional LRT planning effort. One of the fundamental questions at the time was how to develop a comprehensive network of LRT lines that would provide complete coverage of the Twin Cities metropolitan area without duplication of service. To help answer that question, I conducted a study of the LRT system in Portland,

In This Issue:

Oregon, under the sponsorship of CURA and the Center for Transportation Studies at the University of Minnesota, with additional support from the SRF Consulting Group and MnDOT. At the time the fieldwork for this study was conducted, Portland had one LRT line that extended a total of 15 miles from the Portland central business district (CBD) to the suburban community of Gresham. Since that time, Portland has opened a second line to the west, and is constructing a third line that will connect the airport to the existing light-rail system. The study was completed in 1999, at which time I began work at the Metropolitan Council as a transportation planner responsible for LRT and busway planning, which included significant involvement in the development of the 2020 Regional Master Plan for Transit in the Twin Cities.

This article describes what light-rail transit is, presents results and conclusions of the Portland LRT study conducted with CURA, discusses the implications of the Portland study for the Metropolitan Council transit plan and proposed Twin Cities network of transit corridors, and offers some concluding observations regarding present and future transit development in the Twin Cities.

What Is Light-Rail Transit?

Light-rail transit shares characteristics of both subways and streetcars. Subway cars, streetcars, and light-rail transit vehicles are all electrically powered, and operate on a two-rail track that is similar to standard gauge freight railroad tracks. Streetcars and LRT vehicles obtain electricity from an overhead wire, while subway cars use a third rail that is placed near the ground adjacent to the track. As its name suggests, a streetcar operates on tracks that are typically located on the street. Consequently, they are similar to buses in terms of speed and carrying capacity because they are forced to flow with traffic. In contrast, subways can move large numbers of people at high speeds; one operator can manage several cars coupled together into a train, and subway lines are completely separated from the street, often running underground or on elevated structures.

Cover photo: A streetcar operated by the Twin Cities Rapid Transit (TCRT) system circa 1948 turns from Fifth Avenue South onto Washington Avenue, past the Milwaukee Road Depot.

Like subways, which are often referred to as *heavy-rail transit*, light-rail transit operates primarily on tracks that are separated from the street. In certain circumstances, however, such as in downtown areas, it can also operate on or across streets. This is made possible by using an overhead wire for electrical transmission rather than a third rail. Unlike streetcars, LRT vehicles can also be connected into trains, which greatly increases the capacity of LRT. Operating on or across streets when necessary significantly reduces the cost of LRT relative to subways because the extent of underground and elevated construction is limited. However, because operating on street lines causes LRT to be slower than a subway outside of high-density areas, LRT is typically constructed on its own right-of-way, allowing it to avoid the traffic congestion that slows down buses and streetcars.

Another form of rail transit is *regional rail transit*, also known as *commuter-rail service*. A commuter-rail train is similar to an Amtrak-style intercity passenger train, with a locomotive pulling several passenger coaches. Unlike Amtrak trains, commuter trains travel between remote suburbs and the central business district (downtown) of a major city. They typically operate on a schedule designed to serve people who work in the CBD during regular business hours, with inbound trains operating in the morning and outbound trains running in the afternoon. Subways, streetcars, and LRT are generally designed to serve the central city and contiguous suburbs, and usually operate all day long.

Because it can carry more people than streetcars or buses, but fewer than subways or commuter rail, LRT is considered a medium-capacity rail transit system. As noted above, LRT is substantially less expensive to construct than a subway, making it a more practical alternative for transit corridors that do not have the heavy ridership usually associated with a subway system. In comparison with a bus or streetcar system, light-rail transit is more expensive to construct, but less expensive to operate at high passenger volumes because each bus or streetcar requires its own driver.

Light-Rail Transit Service Areas: The Portland Experience

The decision to build a new rail transit system or supplement an existing system requires an understanding of how each rail line in the proposed system will serve the surrounding neighborhood. An efficient network of rail lines will serve as large an area as possible, with little overlap in the service areas of individual routes. The question is, how large is the primary service area for a typical light-rail line?

All transit users in an urban area may periodically take advantage of a rail line, but clearly the closer a person lives to an LRT line or busway, the easier it is to use the system. The Portland study was designed to determine what most people would consider a reasonable distance to travel to get to a station. What constitutes a reasonable distance, of course, is based on the usual mode of transportation the individual uses when traveling to the station. In Portland, most LRT users walk, ride a bus, or travel in a car to get to a station. Because each group represents a distinct market segment, at least three individual service areas exist, corresponding to the three modes of access. A properly designed LRT system must recognize the particular needs of each of these market segments.

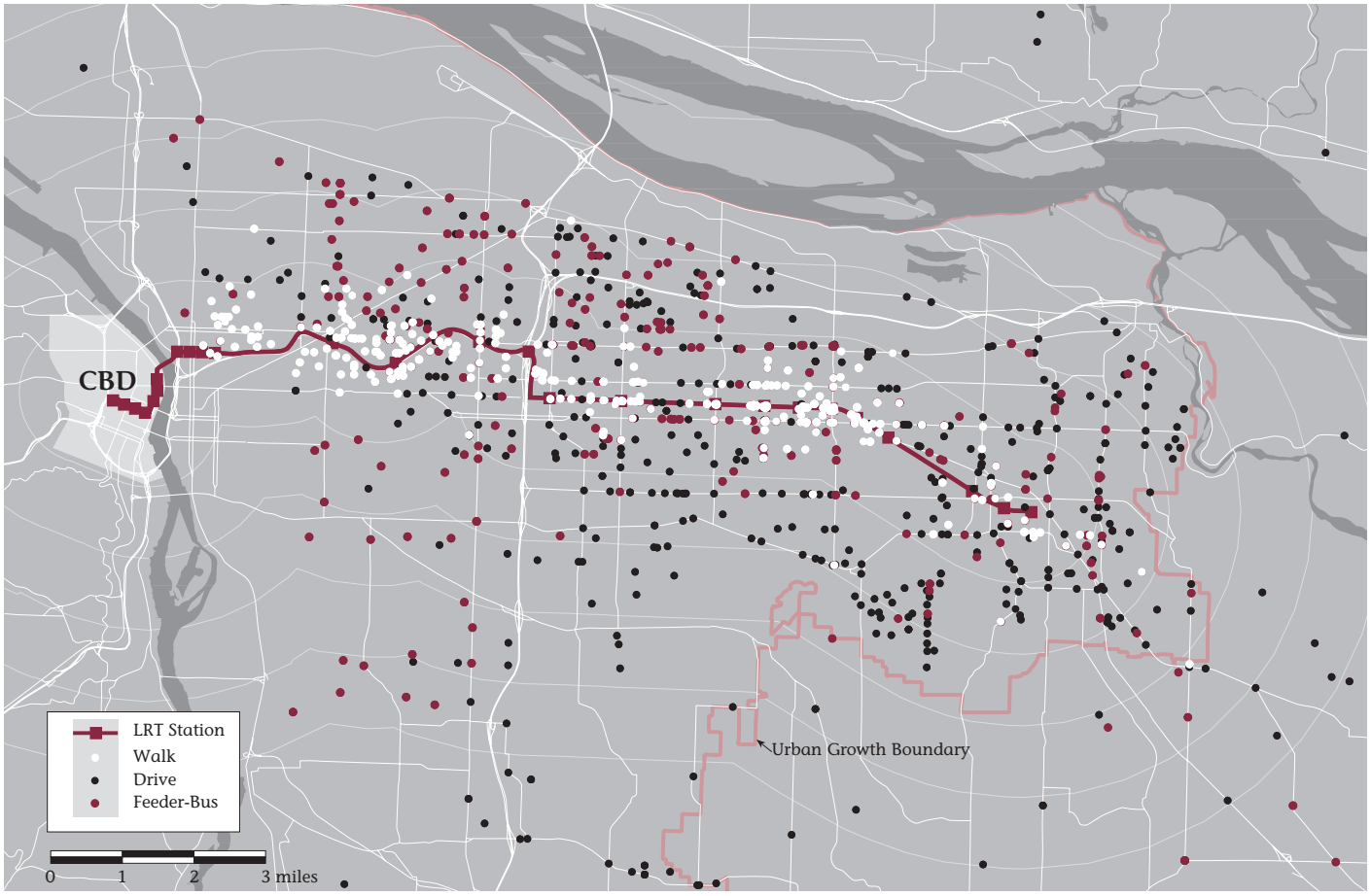
Methodology. To identify each of the three LRT service areas in Portland, a one-page questionnaire was distributed to all adult LRT riders boarding selected trains on the Portland LRT system over a two-week period in April 1991. Each person who completed the onboard questionnaire was given the option of handing it to the surveyor riding the train, or folding it up and returning it by U.S. mail using the business reply form printed on the back. More than 10,000 questionnaires were returned, resulting in an overall return rate of 72%. Of the total number of adult riders, about 55% on the selected trains were sampled during the two-week study period.

The questionnaire asked riders the following:

- Where are/were you coming from?
- At which station did you get on?
- How did you get to the station?
- At what station will/did you get off?
- Where are/were you going?
- How will/did you get to your final destination from the station?

Questions related to the riders' point of origin and final destination were asked in such a way that the person could respond with either an address or the nearest street intersection. Some respondents also used place names. The geographic information system (GIS)

Figure 1. Distribution of Points of Origin and Destinations for Commuter Trips on Portland Light-Rail Transit System, April 1991



software ARC/Info and ARC/View were used to create an electronic map of the Portland street system that also mapped the questionnaire responses, a process called *geocoding*. By geocoding responses, it was possible to record each rider's point of origin and destination, and to map these points with respect to the boarding and alighting stations they used for that trip.

Because weekday commuters going to and from downtown areas are the market that traditional ridership forecast models focus on, survey responses from this subgroup were isolated for further analysis. *Commuters* are people traveling to or from home, and going to or coming from work or school. In transportation planning parlance, such trips are known as *home-based work* and *home-based school* trips. They are also referred to as nondiscretionary trips—that is, trips that have to be taken.

Of the 4,910 weekday riders who returned surveys, only 38% met the criteria for commuter trips. Most weekday riders (62%) were using the system for shopping, recreation, social visits, trips to the doctor, or other discretionary activities, or were traveling to work or school outside of the downtown area. These results suggest that traditional ridership models may falsely assume that most weekday LRT trips are nondiscretionary and are focused on the downtown area. Figure 1 shows the distribution of origins and destinations for the commuter portion of the LRT ridership in the Portland study.

Market Areas of Commuters by Mode of Access. Using GIS software and the geocoded points of origin and destinations of onboard survey respondents, it was possible to calculate the travel distance from each respondent's residence to the station where they boarded the LRT system. Because it is expected that more people come from a location near the station and fewer from a location farther away, it was assumed that the distribution of residential locations would resemble what statisticians call a normal distribution or bell curve, with the highest concentration of residences surrounding the station and the lowest concentration farther away. Figure 2 illustrates how commuters' residences are actually distributed around stations in Portland based on their primary mode of access (traveling in a car, riding a bus, and walking), as well as for all commuters. Because the figure is unidirectional—that is, responses are charted as though all commuters were coming from one direction, rather than from 360 degrees around the station—only half of the "bell" shape can be seen.

In a normal distribution, the standard deviation is a measure of how wide the bell shape is. By definition, the first standard deviation encompasses 66% of all of the observations recorded, and the second standard deviation encompasses 90% of all observations. Accordingly, this study defined the 66th percentile as the *primary service area* and the 90th percentile as the *secondary service area*.

The distances in Figure 2 become more meaningful when the actual locations of riders' residences are mapped against the location of the LRT alignment. This allows us to detect variations that are related to direction, information that cannot be deduced from the simple unidirectional graph shown in Figure 2. As noted earlier, three distinct market areas can be identified based upon the rider's usual mode of travel between home and station: a walk-in service area, a feeder-bus service area,

and a drive-in service area. Each of these service areas will be considered in turn.

Walk-In Service Area. Of commuters who walked to an LRT station, 50% came from within slightly more than one-third of a mile, 66% came from one-half mile, and 90% came from just under one mile (see Figure 2 and Table 1). Based on the definitions for primary and secondary service areas described above, the primary walk-in service area would be a half-mile radius around an LRT station, and the secondary service area would be a one-mile radius. Although 10% of the walkers say they walked more than one mile, this is too great a distance to reasonably expect the average person to walk.

The shape of the walk-in service area in Portland is generally circular around the station. Exceptions occur where there is significant nonresidential land use, when a barrier prevents pedestrians from approaching the station from a particular direction, where stations are closer together than one mile, or when convenient feeder-bus service makes it easier to take the bus. The distance between the station and the downtown area does not affect the shape of the walk-in service area. The generalized walk-in service area is shown in Figure 3.

As a general rule, transit planners have used a quarter-mile walking distance to plan the location of bus routes. The results of this study, and the experience of planners in other cities with LRT, suggest that this rule is not applicable to LRT lines. Instead, a half-mile to one-mile walking distance appears to be a more reasonable guideline for planning purposes.

The results of the Portland study suggest the following additional principles for planning around LRT stations:

- Pedestrian access to stations must be reviewed for a half-mile radius around stations to ensure easy access to stations for people who walk. Some pedestrians who live one-half mile to one mile from the station will still be willing to walk, and attention to the pedestrian environment in these areas is therefore also necessary.
- Land-use planning around stations should also focus on a half-mile radius. Transit-oriented development should be encouraged within this area, with emphasis on providing housing to those who intend to use the LRT system for their everyday travel needs.

Figure 2. Distribution of Commuters' Residences around Light-Rail Transit Stations in Portland by Mode of Access to Station

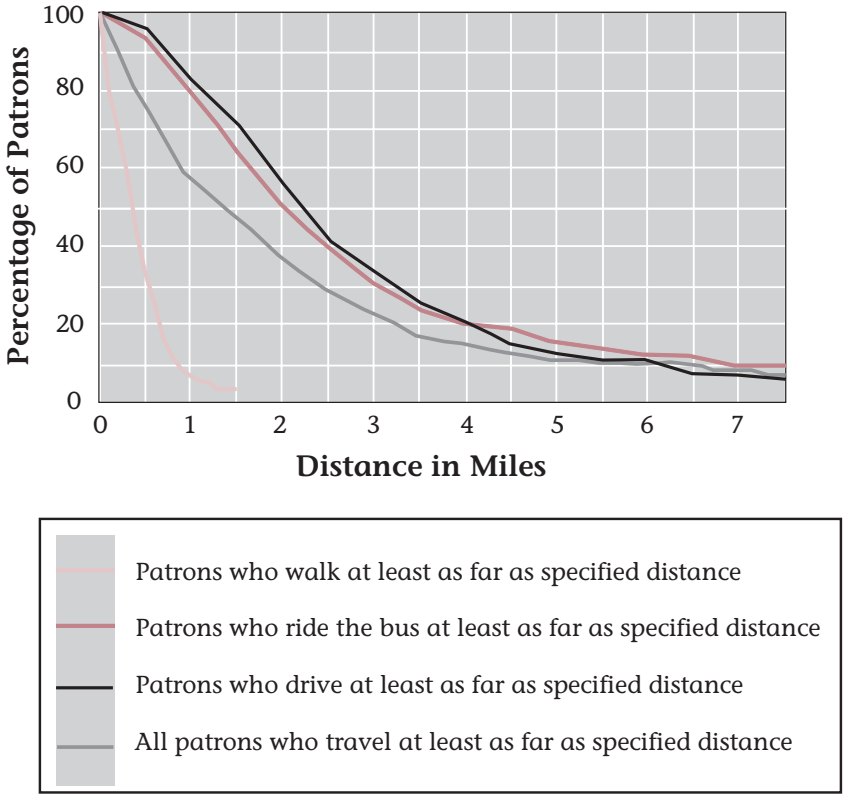


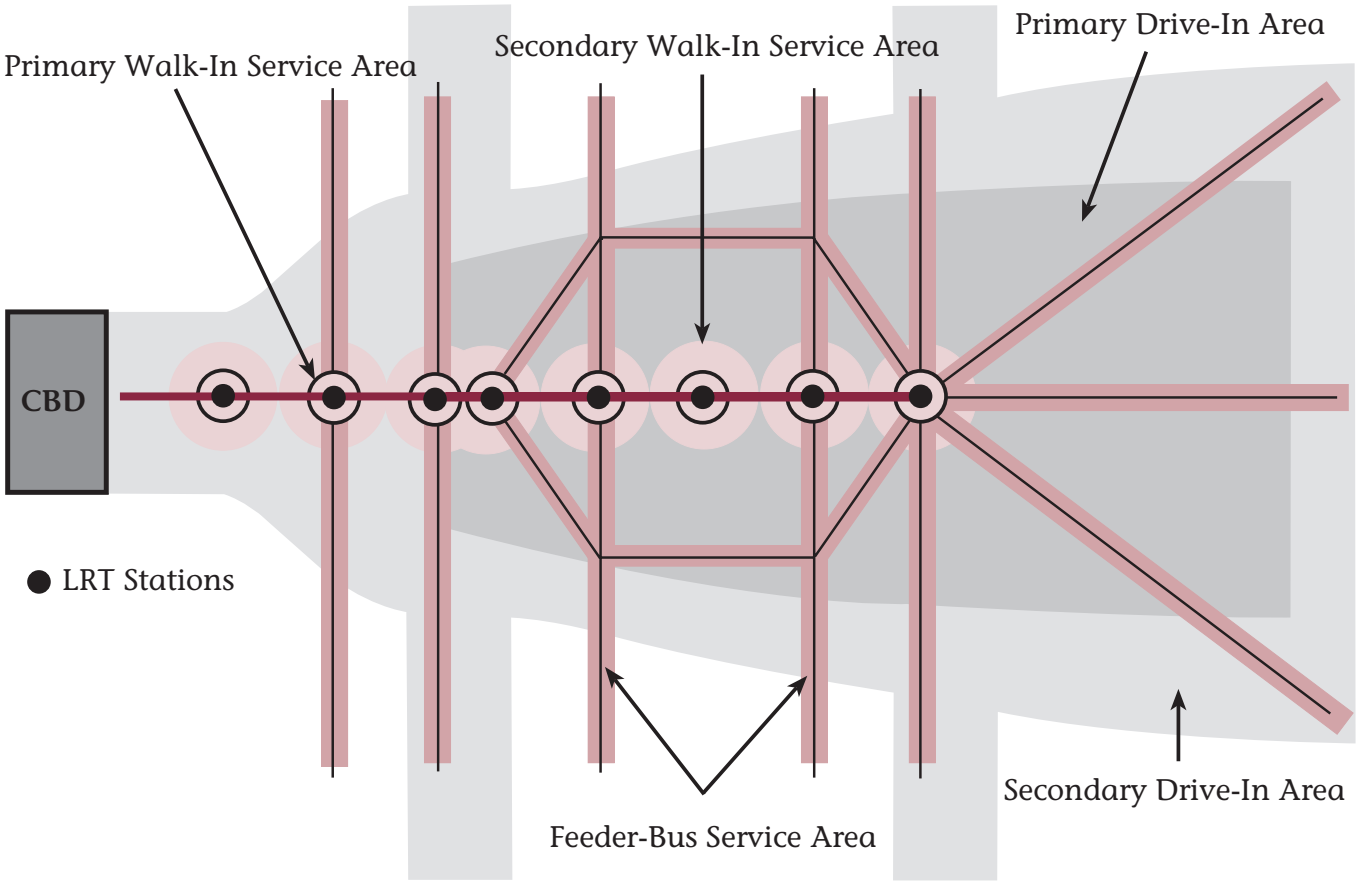
Table 1. Summary of Distances Traveled by Portland Commuters to Reach Light-Rail Transit Station by Mode of Access, April 1991

	Mode of Access			
	Walking	Driving	Feeder bus	Total
Number of patrons	536	1,044	263	1,843
Percentage of total	29%	57%	14%	100%
Minimum distance traveled to station (miles)	.01	.10	.05	—
Maximum distance traveled to station (miles)	3.59	33.22	16.82	—
Average distance traveled to station (miles)	.43	3.24	2.97	2.38
50th percentile for distance traveled (miles)	.35	2.07	2.21	1.41
66th percentile for distance traveled (miles)	.49	2.79	2.99	2.2
90th percentile for distance traveled (miles)	.87	8.06	6.12	5.66

An LRT line with a strong walk-in market is able to provide more frequent service and more hours of service. The better the transit service, the more bus riders and drive-in patrons will be attracted to the line. Focusing on the land use and pedestrian environment in a half-mile radius around LRT stations will therefore have positive impacts on those living outside the walk-in service area.

Feeder-Bus Service Area. Of those respondents in the Portland study who

Figure 3. Generalized Primary and Secondary Service Areas for Walk-In Patrons, Drive-In Patrons, and Feeder-Bus Patrons



rode a feeder bus, 50% came from within 2.2 miles of the LRT station, 66% came from within 3.0 miles, and 90% came from within 6.0 miles (see Figure 2 and Table 1). The median, 66th percentile, and 90th percentile distances varied substantially by station; however, this is a direct result of the configuration of the feeder-bus system. The homes of 75% of the feeder-bus riders are located within two miles of the alignment using straight-line distance. The generalized feeder-bus service area is shown in Figure 3.

The service area for buses is a half-mile band centered on the bus route, equivalent to a quarter-mile distance in any direction from the route. The primary service area for LRT riders using feeder buses includes this quarter-mile band on either side of the bus route, and extends three miles beyond the LRT station along the bus route. The secondary service area is a half-mile band around intersecting bus routes that extends for six miles. Bus routes that require a transfer between buses to get to the LRT are not included in either service area. In addition, bus routes that transport riders to their destination more quickly than light-rail are not considered part of the LRT service area.

This study supports several principles of transit usage that planners are already familiar with. In particular, the walking distance to bus routes that intersect the LRT system is clearly within the quarter-mile walking distance that is traditionally thought of as the service area around a bus route. More importantly, there is an extreme reluctance among transit riders to transfer from one bus route to another to get to LRT. Most bus routes in Portland are either parallel to the LRT system and eventually end up downtown, or are perpendicular to the LRT route and intersect at an LRT station. For riders on parallel bus routes, the time penalty associated with transferring from a bus to LRT is greater than the extra time it takes to simply ride a bus directly to the downtown area. The exceptions are parallel bus routes that turn toward the LRT line and stop at an LRT station, which reduces the transfer time penalty; and bus routes that serve areas beyond the end of the line and feed directly to an LRT station.

Based on the Portland experience, the design of feeder-bus systems should take into account the following principles:

- Feeder-bus routes need to provide direct service to the nearest LRT station without transfer.
- Bus routes must be spaced at half-mile intervals to provide complete coverage of the market area.
- Bus routes near the downtown area or near other major transit generators may as well continue straight into downtown, rather than imposing a transfer time penalty on the transit patron.
- Feeder-bus routes that extend beyond the end of the LRT line can attract riders from long distances in the same general direction of the LRT line.

Drive-In Service Area. Of those respondents in the Portland study who traveled in an automobile to an LRT station, 50% came from within 2.1 miles, 66% came from within 2.8 miles, and 90% came from within 8.0 miles (see Figure 2 and Table 1). The generalized service area for these patrons is shown in Figure 3. The median, 66th

percentile, and 90th percentile distances varied substantially by station. Drive-in distances to a station increase as the distance between the station and the downtown area increases. Distances are also greater for stations that have park-and-ride lots.

For stations within two miles of downtown Portland, there is very little drive-in activity. This is due in part to the lack of park-and-ride facilities, and also to the fact that it is easier to either drive or take a feeder bus to the downtown area. Although there are no official park-and-ride lots at LRT stations located two to five miles from downtown, there is informal park-and-ride activity at these stations. However, the majority of drive-in activity occurs beyond five miles from downtown Portland, beginning with the Gateway Transit Center where the closest park-and-ride lot is located.

The service area for drive-in patrons at LRT stations with formal park-and-ride facilities is comet shaped, with the head of the comet on the side toward downtown and the tail extending away from downtown. The head of the comet extends beyond the station and toward downtown for roughly one-half mile because there is some backtracking to the station. Because drivers tend to use the first park-and-ride lot available to them, the tail tends to disappear as it passes the next park-and-ride facility along the LRT line. An exception to this is the Gateway Transit Center, the closest station to downtown with a park-and-ride lot. Many drive-in users come from long distances to use this park-and-ride facility, bypassing all or some of the more peripheral lots. Around the last park-and-ride lot in Portland, the tail of the comet extends as far as there is development, but only in the general direction of the LRT line.

The width of the comet tail for the drive-in service area is not as great as the average distance calculations from the rider surveys would suggest. At the Gateway facility, the primary drive-in service area extends roughly two miles on either side of the LRT line using straight-line distance. The distance increases to three miles in either direction at the last station on the LRT line with a park-and-ride facility. Although some drive-in patrons may drive long distances before they find a station with available parking spaces, for most trips the distance between the alignment and the patron's point of origin is relatively small because most drivers approach the LRT line from an acute angle. The generalized comet shape is slightly different where intersecting freeways provide good access to a station with ample parking spaces. In these situations, LRT patrons are able to drive much farther in a reasonable time to use the system.

Making parking readily available at LRT stations has the effect of intensifying use by people who are within either walking distance or feeder-bus distance, but who are unwilling to use either of these options. A person who lives within walking distance of a station may still choose to drive. Although some transit patrons will walk up to a mile, about 20% of the drive-in patrons in Portland drive less than a mile, and some drive less than one-half mile.

Clearly, providing adequate parking at selected stations along the entire LRT line can substantially increase usage of the system, even if there is adequate bus service and good pedestrian access. The data collected here suggest that accommodating people who wish to park near stations could more than double LRT ridership. Accommodating drive-in patrons would include the following:

- providing regularly spaced park-and-ride lots along the entire line
- creating large park-and-ride facilities at the end of the LRT line to serve the large patronage coming from the suburbs and outlying areas
- ensuring good street and highway access to all LRT stations, particularly those with park-and-ride lots

Summary of Findings. Planning for an LRT system should include consideration of the characteristics of the primary service area, particularly in the selection of alignments and the location of stations. The primary service area is a 10- to 15-minute travel shed, the shape of which varies by mode of access. Based on the Portland experience, it appears that most LRT riders will walk up to one-half mile to a station. Pedestrian facilities in this area need to be safe, direct, and accessible. Bus riders will generally travel two to three miles if the bus route goes directly to the LRT station. A well-designed feeder-bus system can extend the LRT service area up to two miles beyond the walk-in service area on either side of the LRT alignment, and for several miles beyond the end of the alignment. Depending upon the ease of access to the station and the types of roadways available to the driver, park-and-ride lots can also significantly expand the service area of the LRT system. Parking facilities at LRT stations also intensify usage by people who live within walking distance of the station or have feeder-bus service available.

The Twin Cities Regional Master Plan for Transit

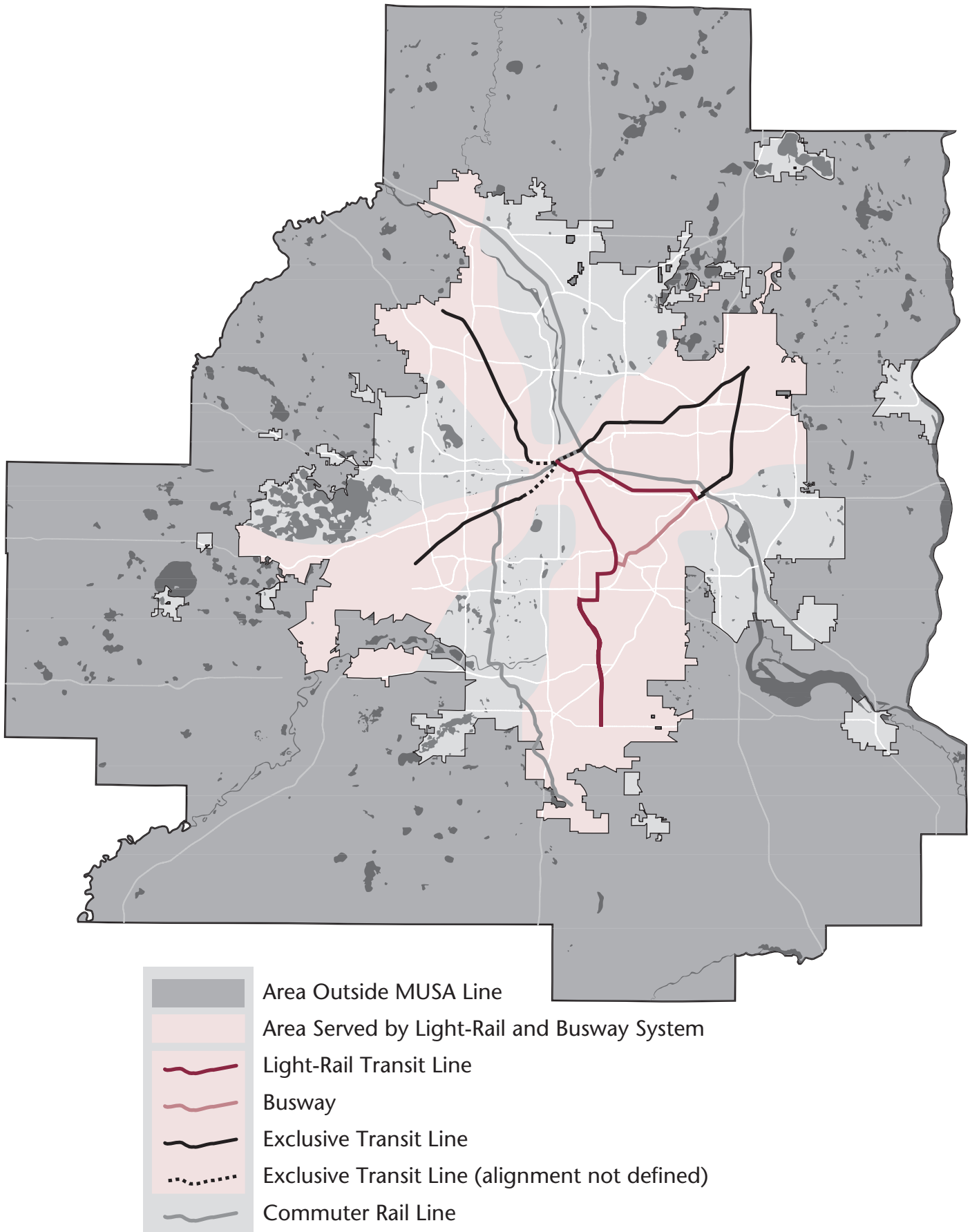
When originally conceived, the Portland study was intended to provide guidance for planners at the initial stages of designing an LRT network for the Twin Cities. Although the development of a new transportation system often has more to do with competing political forces, physical constraints on planners, and available funding than it does with rigorous research, research such as that presented here can prove useful in guiding decision making and assessing the effectiveness of the decisions that result.

The opportunity to apply the findings of the Portland study came shortly after its completion in mid-1999, when the Metropolitan Council began work on the 2020 Regional Master Plan for Transit, issued in January 2000. This plan—which has the objective of doubling transit ridership in the Twin Cities over the next 20 years—outlines a future transit system that integrates all modes of transportation into a unified system, of which LRT is only one component. A major component of the transit plan is the establishment of a network of exclusive transit routes that provide high-speed and frequent transit service.

After years of planning, many potential LRT routes in the Twin Cities have been identified and studied. The transit plan relied heavily on this previous work. Because the eventual system of proposed LRT lines is constrained by the uncertainty of funding during the next 20 years, it was important to include in the plan a limited number of routes that could collectively serve as large an area as possible without overlap between service areas. In addition, the extensive network of shoulder bus lanes and high-occupancy vehicle (HOV) lanes that already support express bus service on Twin Cities freeways also had to be considered.

The transit plan began with the assumption that a core transit system would be completed. The core system, which is shown in Figure 4, includes the Hiawatha LRT line, an LRT line to connect downtown Minneapolis and

Figure 4. Proposed Twin Cities Core Transit System: Light-Rail Transit and Exclusive Busway Corridors



downtown St. Paul, and a busway to connect downtown St. Paul to the Minneapolis/St. Paul International Airport. In addition to these three core routes, the Metropolitan Council has proposed construction of four exclusive transit lines (either light rail or busway), as shown in Figure 4, all of which radiate from one of the two downtowns. Although each of these four additional lines may initially be constructed as a two-lane exclusive busway, it is the Metropolitan Council's intention to eventually convert these radial routes to LRT. If built as a busway, the route and the stations would be located based on an LRT configuration. The objective of building a busway as an intermediate step would be to establish at least some service along each of these routes as soon as possible, rather than concentrating all of the available capital funding on one transit line.

Selecting a route for an LRT line is based on several factors, including ridership potential, the cost of construction, and the availability of a suitable right-of-way. The four radial routes selected for the transit plan are all on existing or former railroad lines, some of which have already been purchased for the construction of LRT. The use of this type of right-of-way minimizes the impact on surrounding neighborhoods, reduces the cost of construction, and nearly eliminates traffic impacts because the train is not operating on streets. Ridership potential is strongly related to the size and character of the area that will be served by the LRT route, and each of these routes is located to maximize the area that can be served by a single transit line.

Figure 4 illustrates the area that will be served by the proposed system of LRT lines based on the concepts developed in the Portland study. The service area includes only portions of the Twin Cities region inside the Metropolitan Urban Services Area (MUSA)—the part of the region that has urban sewer and water service, and on which transportation investments will be concentrated.

As Figure 4 illustrates, the objective of developing a network of LRT lines that serves much of the Twin Cities metropolitan region was achieved. Although there are still some gaps between the service areas of individual lines, the selection of routes was designed around corridors that currently (or will eventually) receive other forms of express transit service. For example, both Interstate 35W and Interstate 394 have extensive networks of freeway express bus service using existing HOV lanes. There are also proposals for the development of a commuter-rail line to connect St. Cloud and Hastings by way of downtown Minneapolis and downtown St. Paul. Although this commuter-rail service is being designed to provide transit service outside the MUSA line, there will be stations in the Anoka, Coon Rapids, and Fridley areas north of Minneapolis, as well as in the Newport and Cottage Grove areas south of St. Paul.

Conclusion

The Portland study reinforces several principles of transit planning that public policy makers ought to consider when determining the location of light-rail transit lines.

- Individual LRT routes need to be planned within the context of the complete LRT network that will ultimately be constructed.
- Priority should be given to those LRT routes that have the potential to serve the most people within their service areas, given the limitations of right-of-way suitability and overall construction cost.
- Priority should be given to developing LRT routes that service areas that are not well served by other modes of mass transit.
- The full value of an LRT line will not be realized unless attention is given to how patrons gain access to the station. This includes adequate parking at all stations, a complete feeder-bus network, and excellent walking accessibility to stations. In addition, attention should be paid to providing bicycle access to the LRT system.
- Land-use planning around LRT stations should extend at least one-half mile in radius, and farther if possible. Developing a strong walk-in market will have positive impacts on those living outside the walk-in service area because it encourages longer and more frequent hours of service.

In addition to improving transportation, development of a light-rail transit system can also help to promote smart growth by encouraging urban redevelopment, regional land-use planning, and the creation of livable urban centers. The Portland study clearly illustrates that the availability of rail transit is a consideration when people look for a residence, with many users choosing to relocate to a residence closer to the LRT line. Employment choices are frequently influenced by the location of rail transit as well. Both of these factors are critical to the realization of smart growth alternatives.

The Metropolitan Council's 2020 Regional Master Plan for Transit attempts to incorporate these transit planning principles, both to improve transportation and to encourage smart growth. Funding uncertainties during the next 20 years make it unrealistic to expect that the entire Twin Cities region will fall within one of the LRT service areas. Nonetheless, by applying the definition of service area developed through the study of the Portland LRT system, it is clear that the proposed system of light-rail transit, exclusive transitways, and busways for the Twin Cities will serve most of the metropolitan area inside the MUSA line. If the initial system can be successfully implemented, then future LRT routes can be designed to fill in remaining gaps in service in the metropolitan area.

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What Works at Work? Evidence from the Minnesota Human Resources Management Practices Study

by Avner Ben-Ner, Fanmin Kong, Tzu-Shian Han, Nien-Chi Liu, Yong-Seung Park, and Stephen J. Smela

Recent debates about the future of Minnesota's economy have focused on a number of key factors thought to underlie competitive success, such as the amount of venture capital received by Minnesota start-up businesses, the efficiency with which the University of Minnesota converts its discoveries into marketable goods and services, and the number of Fortune 500 companies headquartered here.

Often overlooked as a source of competitive advantage, however, is the technology of managing workers—that is, the day-to-day practices of human resources management. Basic decisions such as how compensation structures are set, how decision-making rights are allocated, and how much training employees receive have major effects on organizational performance and, by extension, the health of the regional economy. In fact, with unemployment rates at historic lows, finding, retaining, and deploying workers in the most effective manner has emerged as the leading economic issue in Minnesota.

At the same time, human resources technologies have evolved dramatically during the past 20 years—401(k) plans, stock options, cross-functional work teams, employee stock-ownership plans, and joint labor-management committees are just a few innovations that have revolutionized the workplace in the United States.

Given the importance of human resources to Minnesota's continued economic health, during the past five years researchers from the Industrial Relations Center (IRC) at the University of Minnesota's Carlson School of Management have been documenting the spread of innovative human resources management practices within the state, and delineating their impacts on employers and employees alike. This article presents results from the 1994–1996 Minnesota Human Resources Management Practices Study (MHRMPS), which was supported by grants from CURA, the Sloan Foundation, and the University of Minnesota's Retail Food Industry Center.

The MHRMPS had three main goals: to gain a detailed picture of which human resources practices have been adopted over time; to determine how the mix of practices differs across industries and ownership structures; and to evaluate the relationships between human resources practices and employee productivity, firm profitability, and workplace safety. This article describes the methodology of the MHRMPS; summarizes findings related to the adoption of human resources practices and their distribution across industries and ownership structures; discusses factors that influence the adoption of particular practices; considers the impact of particular human resources practices on workplace safety, employee productivity, and firm profitability; and offers concluding remarks regarding the adoption of human resources practices by Minnesota businesses.

The Minnesota Human Resources Management Practices Study

The study focused on 2,021 private, for-profit, Minnesota-based firms with at least 20 employees representing a broad spectrum of industries, ownership types, and sizes. The dataset used for the study included information supplied directly by firms through a survey instrument, data made available by Minnesota state agencies, and other publicly available information. In addition, we also assembled some information about the industries in which sample firms operate, and about the Minnesota counties in which they are located. Below we describe how the MHRMPS dataset for sample firms was constructed, emphasizing our collection of original survey data.

The Minnesota Human Resources Practices Survey. The survey sought to obtain information about human resources management and the organization of work in Minnesota companies. The questionnaire asked respondents about plans and programs that involve employees in decision making (for example, through self-managed work teams) or in the financial returns of the company for which they work (for example, through individual or group incentives such as profit sharing); supporting human resources practices (such as training, employment security, and job design); the degree of employee participation in decision making; the degree of information sharing with employees; the nature of the tasks carried out by different groups of employees; the company's reliance on computerized technology; and various aspects of firm organization. The survey also asked when various programs and practices were introduced or discontinued. The survey questionnaire was pilot tested on 11 firms in October and November 1993, and was subsequently circulated for comments among colleagues at various universities.

The sample of firms we surveyed was intended to include a diverse group of Minnesota-based firms that represent both the variety of workplace programs and practices found in U.S. corporations, and the wide range of technologies and other factors that are likely to influence the organization of work within a particular firm. The sample was constructed from among four primary groups of firms:

1. All 291 Minnesota firms that appeared on the Security and Exchange Commission's (SEC) 1993 Compact Disclosure database of publicly traded companies;
2. A total of 296 private Minnesota companies identified by various sources as having an employee stock ownership plan in 1993;
3. All 476 retail and wholesale food industry firms in Minnesota with 20 or more employees that were listed in a 1995 dataset compiled by Dun and Bradstreet;

4. A randomly selected group of 958 Minnesota firms with 20 or more employees that were listed in the 1995 Dun and Bradstreet dataset.

The survey was conducted in two waves: firms in the first two groups were mailed the survey in mid-1994, while firms in the last two groups received the survey in early 1996. We received responses from 874 firms, yielding a response rate of roughly 43% (see Table 1). Of the 874 surveys returned, 806 were used in our analyses; the remaining 68 were excluded either because they were duplicates (7), because the firm did not operate principally in Minnesota (11), or because there were fewer than 20 employees at the firm at the time of the survey (50).

Basic characteristics of responding firms are listed in Table 2. The average firm is fairly large, with a mean of 760 employees. This is a result of having a few large retail firms among the respondents. The average age of all firms at the time of the survey was approximately 36 years; by industry, average ages ranged from almost 50 years (service firms) to around 30 years (commerce firms). Almost one-fourth (23%) of the survey respondents were publicly traded, with the highest proportion in manufacturing and the lowest in commerce.

Wage and Employment Data. Data on wages/salaries and employment for most of the 2,021 firms in the sample were acquired from the Minnesota Department of Economic Security. The data are available only at the level of individual establishments, so we combined them to yield a total for the firm as a whole. No individual employee data were made available to us.

Occupational Safety Data. Data for all workplace injury claims filed against the 2,021 sample firms during the period 1983–1995 were obtained from the Minnesota Department of Labor and Industry. The department's database contains "first reports" of injuries filed in 1993 and 1994. First report forms classify injury claims by type of injury (such as strain or laceration) and body part (such as back or neck), and include information about employee age, gender, and occupation.

Pension Benefits and Deferred Compensation. Detailed information about employee stock-ownership plans, deferred profit sharing, and various pension plans was extracted from U.S. Internal Revenue Service Form 5500 Series data files. Companies are required to report on such plans under the Employee Retirement Income Security Act of 1974, and these data files are publicly available. The data files include, for each individual plan, the number of active participants, total asset value, and other financial information.

Table 1. Response Rates for Minnesota Human Resources Practices Survey by Type of Firm

	Publicly Traded Companies	Private Companies	Retail and Wholesale Food Firms	Randomly Selected Firms	Total
Surveyed	291	296	476	958	2,021
Nonrespondent	114	133	303	597	1,147
Respondent	177	163	173	361	874
Response rate	61%	55%	36%	38%	43%

Other Datasets. Financial and ownership data for public firms are available from a number of public sources. Publicly traded firms are required by law to report data for the benefit of their shareholders. Nevertheless, complete financial data were available for only about one-third of public firms in Minnesota.

Prevalence of Human Resources Practices

This section summarizes information derived from the survey questionnaire, with a particular focus on the prevalence of human resources practices, and the nature of core employees' tasks and skills at the companies surveyed.

In general, human resources practices can be grouped according to two sets of criteria: (1) the level at which they operate (individual employees, groups of employees, or the whole firm); and (2) the nature of the practice (participation in decision making, participation in financial performance, or supporting practices).

Programs fostering employee *participation in decision making* include, at the individual level, latitude for employees to make discretionary decisions; at the group level, various plans that involve employees in making decisions (such as quality circles, self-managed work teams, and joint labor-management committees); and, at the firm level, employee representation on the board of directors.

Plans that provide for employee *participation in the financial performance* of the firm tie the employees' compensation to some measure of performance. Individual financial performance plans include commissions and performance-based pay. Group bonuses and gain-sharing programs are examples of group-level financial performance plans, while stock purchases, cash profit sharing, deferred profit sharing, and employee stock ownership plans are firm-level financial performance plans.

Finally, *supporting practices* are those that complement the first two categories. For example, self-managing work teams may not live up to their promise if workers do not receive training in team-building skills. Individual-oriented supporting practices include skill-based pay, employment security, and training

Table 2. Characteristics of Survey Respondents by Sector

	Sector			
Characteristics	**Manufacturing**	**Service**	**Commerce**	**All Firms**
Number of firms	310	154	342	806
Average number of employees	648	567	949	760
Average birth year of firm	1959	1947	1965	1960
Percentage publicly owned	34%	28%	11%	23%
Percentage unionized	25%	9%	18%	19%

in statistical analysis; group-based practices include job rotation, job redesign, and training in team-building skills.

Figure 1 shows the proportion of firms with at least one program in each category (excluding suggestion and employee-discretion programs), with human resources practices classified into five categories based on the nature of the practice and the level at which the practice operates. The figure illustrates the growth in usage of these human resources practices during the study period (1980 to 1996). Clearly, programs to promote employee participation in decision making and the financial performance of the firm have increased dramatically since the early 1980s, with particularly strong growth in the second half of the 1980s. The most prevalent type of plan throughout the period was group-based participation in financial performance, with nearly two-thirds of respondents using this approach by 1996. The proportion of firms providing group-based participation in decision making increased more than fourfold, from 11% to 48%. Although the trends cut across all industries, they were most pronounced in the manufacturing sector and were least significant among firms engaged in commerce.

Table 3 shows the incidence of human resources practices among respondents at the time of the survey. Employee participation in decision making was most common at the level of the individual employee; suggestion systems were used by more than half of the firms surveyed, and individual discretion in decision making was relied upon by 42%. Manufacturing firms tended to use self-managing work teams, joint labor-management committees, and quality circles at higher than average levels. In general, group-based systems were used by one-sixth to one-fifth of all firms. Only a few firms had employee representatives on the board of directors.

Among plans that provided for employee participation in the financial performance of the firm, individual-oriented plans were used by approximately one-third of survey respondents, with rather consistent levels reported across all industries. Group-based bonuses, cash profit sharing, employee stock ownership plans, and deferred profit sharing were used by one-fifth to one-fourth of firms overall. Interestingly, firms in the manufacturing sector used these plans at a higher rate than firms in services or commerce. A smaller percentage sponsored stock purchases by employees, and only a tiny fraction of firms used gain sharing (although the proportion of gain-sharing options in manufacturing is almost double the average for all industries). As noted above, almost two-thirds of all firms had some kind of group-based financial performance plan in place; the smaller proportion of individual-oriented plans indicates that, to some extent, these plans are substitutes for each other.

With respect to supporting practices, promotion from within, training in team-building skills, and skill-based pay were used in a consistent manner across industries. Firms in the service sector were markedly less likely to use job rotation, and service and commerce firms lagged behind in the adoption of employment security and training in statistical analysis. Manufacturing firms were less likely to have adopted job redesign as a supporting practice.

The tasks of core employees (those who carry out the main activity of a firm) can be characterized in various ways. In this article, however, we consider only the complexity of tasks, and the extent to which the tasks of different workers are interdependent. On a scale of 1 to 5, we found that the average task complexity for workers is roughly 3. The interdependence of tasks is significant on average, and similar across all industries. However, manufacturing and service firms report that their employees execute more complex tasks than firms engaged in commerce. The skills required of workers in manufacturing and service firms are greater on average than those in commerce, and the skills seem to be slightly more firm-specific in the manufacturing and service sectors than in commerce.

Some of the relationships between task complexity and human resources practices can be seen by examining the data in Table 4. Greater complexity is associated with substantially greater reliance on employee involvement in team work. Of the firms that report that their core employees' tasks are not at all complex, only 11% have self-managed teams and 2% have quality circles. In contrast, among firms that report that

Figure 1. Rate of Participatory Human Resources Practices, 1980–1996

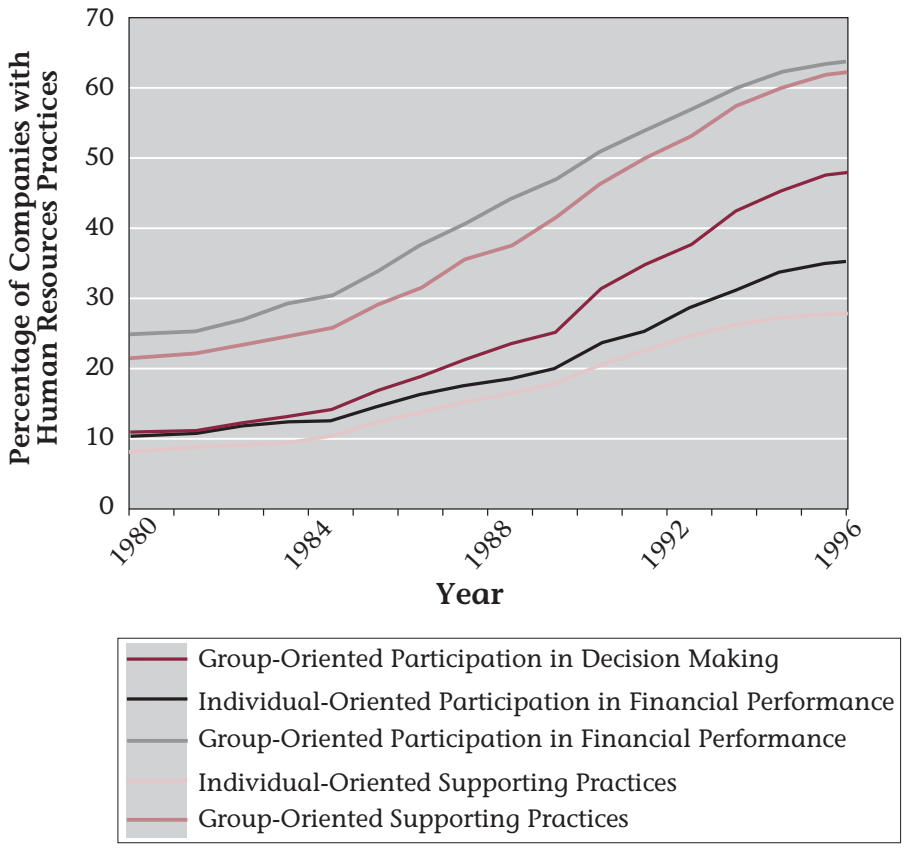


Table 3. Incidence of Human Resources Practices among Survey Respondents by Sector (%), and Attributes of Core Employees' Tasks and Skills (5-point scale)

	Sector			
	All Firms	**Manufacturing**	**Service**	**Commerce**
Participation in Decision Making				
Employee discretion	42	47	46	34
Suggestion systems	53	52	49	56
Self-managing work teams	22	27	19	19
Joint labor-management committees	17	21	10	15
Quality circles	14	16	13	12
Employee representation on board of directors	7	5	10	8
Participation in Financial Performance				
Individual incentives	34	32	36	35
Group bonus	23	23	21	23
Gain sharing	4	7	2	3
Cash profit sharing	22	28	17	19
Employee stock ownership plan	22	28	24	15
Deferred profit sharing	21	23	21	18
Stock purchase	12	18	13	6
Supporting Practices				
Promotion from within	80	78	75	85
Employment security	22	27	19	19
Skill-based pay	16	15	13	18
Training in statistical analysis	15	26	7	10
Training in team-building skills	42	44	36	42
Job rotation	30	34	14	33
Job redesign	12	9	13	13
Attributes of Core Employees' Tasks and Skills (1 = not at all and 5 = extreme)				
Complex	2.95	3.11	3.19	2.69
Interdependent	3.62	3.68	3.66	3.55
High skill required	2.90	3.06	3.17	2.63
Transferability of skills to other firms	3.63	3.48	3.87	3.64

tasks are extremely complex, 44% have self-managed teams and 24% have quality circles. In other categories the association is much less apparent, or even lacking altogether. This suggests a possible link between complexity and decision-making plans.

A link between complexity and skill is also evident in Table 4. Extremely complex tasks are associated with much greater skill requirement (4.41 on a scale from 1 to 5) than tasks that are not at all complex (1.57). The skills associated with more complex tasks are somewhat easier to transfer from one firm to another than are the skills that serve simpler tasks. In addition, the greater the complexity of tasks, the greater the likelihood that they will be involved in interdependent relationships with other tasks.

Influences on the Adoption of Human Resources Management Practices

As Figure 2 illustrates, a firm's choice of human resources management practices can be viewed as an intervening force between a set of given factors and a series of outcomes. A firm chooses particular human resources practices to optimize a set of desired outcomes—such as profitability, productivity, workplace safety, or wages—for the firm and its employees. The choices will vary among different firms because they generally face different contingencies. These might include such things as a firm's business strategy; the technology of production; market forces; and the firm's size, age, and ownership structure.

Human resources practices influence desired outcomes in two ways. The first is the impact of individual practices in and of themselves. For example, providing bonuses for the attainment of specific safety outcomes should, by itself, result in fewer injuries. The second type of influence is through the interaction of human resources practices with each other. To continue with the previous example, financial rewards alone may do little to improve safety if employees have no ability to choose or implement safer courses of action. Moreover, financial incentives and decision-making rights cannot be fully effective, even if well aligned with each other, if they are not complemented by appropriate training and other supporting practices.

The relationship among different practices can be complex, and the choice of a package or system of human resources practices may be quite complicated as a result. Suppose, for example, that a company seeks to induce its employees to invest in nontransferable skills—that is, skills that are useful mostly to the company, and that have relatively little value elsewhere. In addition to offering appropriate training programs, the firm may have to engage in further restructuring of its human resources practices. Employees will invest willingly in firm-specific skills if they believe that they are likely to stay with the company for a long time. Hence, the company would be wise to offer some assurance of continued employment (perhaps through a pledge of employment security), and to tie the future material well-being of employees to productivity by issuing stock to them (perhaps through an employee stock ownership plan). Furthermore, if employee skills are best deployed by granting individual or team decision-making autonomy, then appropriate plans for employee input also have to

Table 4. Incidence of Human Resources Practices in Relation to Complexity of Tasks of Core Employees (%) and Task and Skill Attributes (5-point scale)

	Complexity of Tasks				
	Not at All	**Small**	**Moderate**	**Large**	**Extreme**
Participation in Decision Making					
Employee discretion	13	25	35	59	76
Suggestion systems	36	55	54	55	56
Self-managing work teams	11	13	22	31	44
Joint labor-management committees	17	18	15	18	18
Quality circles	2	8	13	22	24
Employee representation on board of directors	2	7	7	10	12
Participation in Financial Performance					
Individual incentives	26	35	29	43	46
Group bonus	19	21	23	25	32
Gain sharing	6	2	5	6	2
Cash profit sharing	15	20	24	21	30
Employee stock ownership plan	19	14	22	31	34
Deferred profit sharing	19	18	21	20	28
Stock purchase	13	10	9	19	18
Supporting Practices					
Promotion from within	79	81	82	82	72
Employment security	23	23	22	22	26
Skill-based pay	4	12	17	3	20
Training in statistical analysis	8	12	18	15	24
Training in team-building skills	23	36	43	49	58
Job rotation	26	33	31	28	26
Job redesign	11	10	11	14	14
Attributes of Core Employees' Tasks and Skills (1 = not at all and 5 = extreme)					
Interdependent	3.32	3.49	3.59	3.84	3.94
High skill required	1.57	2.24	2.82	3.79	4.41
Transferability of skills to other firms	3.42	3.47	3.59	3.79	4.08

be devised. Such plans may, in turn, necessitate financial incentives, perhaps through programs that grant employees participation in firm performance.

The foregoing discussion can be summarized by putting forward two principles that underlie the rational combination of individual human resources practices into work/human resources systems. The first is the principle of *horizontal consistency*, which refers to a complementary relationship among the different categories of human resources practices. This principle implies that decision-making rights, for example, should be supported by appropriate incentives such as financial returns participation, and that both decision making and financial returns participation have to be backed by appropriate supporting practices such as training, sharing of relevant information, investment by employees in their skills, assurances by employers that employment is secure and that acquisition of firm-specific skills will not disadvantage employees, and so on.

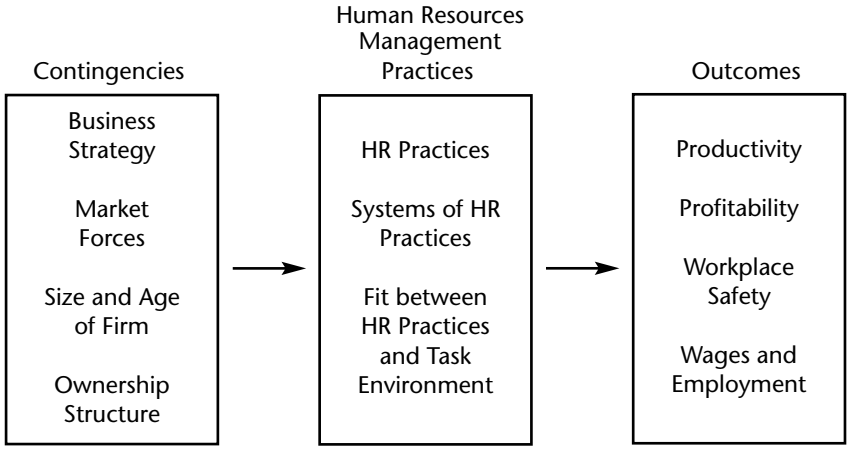
The second principle concerns *vertical consistency*, which refers to the relationship between practices at different levels of the organization. This principle implies that practices at different levels should not contravene each other. If, for example, group decision making and group participation in financial returns are considered desirable, then there should be little reliance in the organization on individual-oriented practices.

Because the influences in the left-hand box in Figure 2 are, for the most part, either things a firm can change only with difficulty or things over which it has little control, we now turn to a consideration of the fit between human resources practices and the task environment (found in the middle box). Two major dimensions of task environment form the basis of our analysis: the *uncertainty of outcome* of the employees' efforts, and the *interdependence* among employees' work.

Uncertainty of outcome stems primarily from the complexity of an employee's tasks. Complexity prevents both the employee and his or her supervisor from being able to predict the exact outcome of a given task. To illustrate, let us compare a situation in which the outcome is quite easy to predict—such as collecting tolls at a toll booth—with one where it is not—say, developing a new Internet software application. The toll collector's tasks are fairly simple, and the work can be governed by simple rules and monitoring. In contrast, the software developer's tasks are significantly more complex and less predictable. Almost by definition, this situation demands that the employee exercise judgment and individual discretion rather than follow a simple set of rules or procedures handed down by a supervisor. Furthermore, such complex tasks will likely require consultation and cooperation with other software developers, as well as joint decision making with coworkers in the context of a work team. Generally speaking, the greater the complexity of tasks and the higher the uncertainty of the outcome, the more useful it becomes to involve employees in decision making.

If uncertainty influences the *amount* of employee involvement, the level of interdependence between employees helps determine the *scope*—that is, whether these programs should operate at the individual or group level. In general, the more employees rely on each other to complete tasks, the more useful group-based programs are.

Figure 2. Relationship between Contingencies, Human Resources Management Practices, and Outcomes



As noted, to generate the right fit between human resources practices and the overall task environment, these practices must be designed with a view to the contingencies an organization faces. The most important contingencies are those imposed on the task environment by the firm's business strategy and the nature of market forces. Business strategy refers to how a firm creates its competitive advantage: Does it focus on being a low-cost producer? on quality? on product innovation? Market forces include conditions such as whether demand is growing or declining, steady or fluctuating, and the nature of competition in the industry. The firm's size, age, and ownership structure serve as important factors as well. Based on combinations of these factors, human resources practices can vary within an industry and size class. Similar-sized restaurants, for example, will have different practices depending on whether they serve the high or low ends of the market. Many of these contingencies manifest themselves at the level of the individual worker by influencing the tasks workers have to execute and the skills they need for effective execution of these tasks. The task environment may call for human resources practices that rely to different degrees on employee involvement in decision making and in financial returns, and that are oriented to the individual employee, groups of employees, the entire firm, or a combination thereof.

The principles we have just considered suggest a number of hypotheses that we sought to test using regression analysis and data from the MHRMPS. Regression analysis is a standard statistical technique used to quantify the relationship between a dependent variable and an independent variable (or variables). Some of the key findings of our analysis are presented in Table 5. The dependent variables we sought to analyze are listed across the table, and include the broad categories of practices presented in Figure 1—namely individual and group participation in decision making, individual and group

Table 5. Determinants of Human Resources Practices Logistic Model*

	Individual-Oriented Participation in Decision Making	Group-Oriented Participation in Decision Making	Individual-Oriented Participation in Financial Returns	Group-Oriented Participation in Financial Returns	Individual-Oriented Supporting Practices	Group-Oriented Supporting Practices
Task Environment						
Complexity	+	+	+	+	+	+
Interdependence	+	+	+	+	-	+
Transferability	+	+	+	-	-	+
High skill	+	+	+	+	+	+
Control Variables						
Number of employees	-	+	+	+	+	+
Firm age	+	+	-	+	-	-
Unionization	+	+	+	-	-	-

* Multiple regression analysis was used to examine the multivariate relationship between the independent variables (listed in the far left column) and the six dependent variables. The results are listed in simplified form as follows, with bold characters indicating a statistically significant relationship at a probability level of .01 or better ($p < .01$):

- A "+" indicates a positive relationship between the two variables, holding all other variables constant. This means that higher levels of a particular independent variable (greater task complexity, interdependence, skills transferability, skill level, more employees, greater age of firm, or unionization) were found to be associated with a greater likelihood of a certain dependent variable (individual or group-oriented participation in decision making, participation in financial returns, or provision of supporting practices).
- A "-" indicates a negative relationship between the two variables, holding all other variables constant. This means that higher levels of a particular independent variable were found to be associated with a lesser likelihood of a certain dependent variable.

participation in financial returns, and individual- and group-oriented supporting practices. The independent variables are listed in the left-hand column, and include descriptors of a firm's task environment (complexity, interdependence, and the level and transferability of the skills required to execute them), as well as several control variables (number of employees, age of firm, and unionization status).

We have indicated statistical relationships among the variables by using a "+" (positive relationship) or "–" (negative relationship), with statistically significant results indicated by bold characters. The results of our analysis highlight the importance of task uncertainty in shaping human resources practices, as indicated by the results for the task complexity variable. The data are consistent with the hypothesis that firms respond to the complexity of tasks by involving employees in decision making at both the individual and group level, and by offering them individual and group financial incentives. As we predicted, task interdependence is also directly associated with a greater reliance on employee involvement in decision making. However, we did not find a significantly increased reliance on collective incentives due to interdependence of tasks, contrary to our expectations.

Table 6. Associations between Human Resources Practices and Profitability, Occupational Safety, and Wages

	Profitability, Occupational Safety, and Wages	
	All measures above average	All measures below average
Firm and Employee Characteristics		
Average number of employees	2,000	300
Average age of company	40	20
Union status	may be union	non-union
Average age of employees	40	30
Average tenure of employees	8	2
Task Environment and Skills		
Task complexity	very high	very low
Task variability	high	low
Employee skills	very high	very low
Human Resources Practices		
Team work	prevalent	not used
Employee ownership	widely offered	not offered
Profit sharing	widely offered	not offered
Employment security	may be offered	not offered
Training	may be offered	not offered
Pay for skill	may be offered	not offered
Job rotation	may be offered	not offered

Outcomes for Firms and Workers

How do human resources practices contribute to the well-being of workers and shareholders? This important question is the focus of our present efforts under a grant from the Centers for Disease Control and Prevention and the National Institute for Occupational Safety and Health. This three-year project uses data that were generated by the MHRMPS, as well as information collected from human resources managers, supervisors, and line employees. The project is in its final year, and the investigators are currently completing data collection and beginning data analysis.

To reach an initial understanding of how different dimensions of firm performance are affected by various human resources practices, we used regression analysis and other statistical analyses to examine the factors that contribute to above- or below-average outcomes for profitability, occupational safety, and wages. These analyses generated several preliminary findings, which are summarized in Table 6. The table focuses on two broadly defined types of firms: healthy and unhealthy. Unhealthy firms produce below-average outcomes for employees and shareholders, while healthy firms produce above-average outcomes for both groups. The table omits firms that generate above-average outcomes for one group and below-average outcomes for the other group. Shareholder outcomes (profitability) refer to returns on stock. Employee outcomes include the average wage in the firm in which they work, and occupational safety as measured by the incidence of injuries. A firm's average for each of these three variables was considered relative to the industry in which the firm operates, so that a high-technology firm was compared with other high-technology firms, a fast-food restaurant with other fast-food restaurants, and so on.

Table 6 lists firm and employee characteristics, task environment and skills, and human resources practices that may be associated with shareholder and employee outcomes. Based on our initial analysis, it appears that healthy firms are more likely to have employee involvement in decision making and financial returns, particularly at the group and firm levels, compared to unhealthy firms. In other words, more participatory firms generate better returns to shareholders, provide safer workplaces, and offer higher wages to their employees. Healthier organizations are also characterized by more complex task environments compared to other firms in their own industries, and employ older workers with more skills and longer tenure than unhealthy firms (again, relative to other firms in their own industries). Healthy firms are typically more established and larger than unhealthy firms as well.

Finally, with respect to the fit between a firm's task environment and its human resources practices, it appears that greater task complexity is associated with firms that allow employees to participate in both decision making and firm financial returns. This appears to support the idea that a better fit between the contingencies listed in Figure 2 and the human resources practices of a firm tends to generate better outcomes for both shareholders and employees.

We should note that the number of observations underlying our results for productivity and economic performance

is somewhat small, due to the availability of information only for publicly traded companies. Recent additions to our data collection, which incorporate results from our newly completed survey, will enable us to update our analyses in the near future and achieve more reliable results.

Conclusion

The organization of work and the human resources practices that accompany it have been thoroughly transformed since the early 1980s. By and large, the "new" workplace relies more heavily on employee involvement in both decision making and in firm performance, requires greater worker skills, and entails more complex tasks than the "old" workplace. The proportion of firms without plans that provide for employee participation in decision making or financial returns has declined from more than 60% in the early 1980s to less than 30% by the mid-1990s. The proportion of firms that have both decision-making and financial returns plans has increased from about 5% to almost 30%.
A number of changes in the economy are responsible for these transformations, but the single most important factor has been the increased reliance on computer-based technologies.

Although the changeover to computer technology has been sweeping, it has not swept all firms equally, nor has the change been equally successful. Many occupations that required fewer skills and less complexity in the past—such as those of line workers in manufacturing, services, and commerce—have become more complex and interdependent. In addition, the task of organizing workers has become much more complex than in the times of relative stability in the economic and technological environments. Thus, the knowledge held and practices exercised by executives and managers in earlier decades are no longer as useful for structuring human resources practices as they once were. The flexibility that is being demanded of most employees is also required of those in positions of responsibility. Those managers who succeed in figuring out their firms' contingencies and who choose the appropriate human resources practices that foster employee productivity, firm profitability, and workplace safety benefit both employees and shareholders. Others are leading less successful companies or outright unhealthy firms, firms whose future is in doubt particularly in periods of shake-up and shake-out in the economy.

Determining the optimal combination of human resources practices is not an easy matter. The decision must be made in the context of preexisting conditions, such as the nature of competition in the firm's industry or the nature of the tasks the firm's employees perform. Consideration must be given not only to the potential effects of individual practices on desired outcomes, but also to possible interactions and conflicts between them. Finally, it may not be possible to obtain optimal results on all measures simultaneously; for example, improved profitability may be achieved through practices that increase the number and duration of workers' compensation claims.

The MHRMPS data represent a snapshot of human resources practices and their outcomes at a particular point in time. As we continue to add to our data collection, we hope to investigate the impact of particular human resources practices over the longer term.

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Other Projects Related to the Minnesota Human Resources Management Practices Study

For more information about the Minnesota Human Resources Management Practices Study (MHRMPS), or current work on this project that is being continued under the sponsorship of the Centers for Disease Control and Prevention and the National Institute for Occupational Safety and Health, contact Dr. Avner Ben-Ner, Industrial Relations Center, 3-300 Carlson School of Management, University of Minnesota, Minneapolis, MN 55455.

MHRMPS was the foundation for a number of doctoral thesis projects by graduate students at the University of Minnesota's Industrial Relations Center, including those listed below.

- Tzu-Shian Han, "Employee Participation in Decision Making and Financial Returns: Effects on Firm Performance" (1995).
- Yong-Seung Park, "Occupational Safety: Effects of Employee Participation Plans in Decision Making and Financial Returns" (1997).
- Nien-Chi Liu, "Determinants of Innovative Human Resources Practices and Systems" (1998).
- Fanmin Kong, "The Effects of Profit Sharing Plans and ESOPs on Firm Employment Fluctuations" (in progress).

and research interests in human resources management practices, workers' compensation, and occupational safety.

Stephen J. Smela earned a Ph.D. in geography from the University of Minnesota in 1998 for his work on the geographical diffusion of employee stock ownership plans. He now works at the Human Resources Research Institute in the Industrial Relations Center at the University of Minnesota's Carlson School of Management.

CURA provided seed money for this research project, and leveraged additional support from the Sloan Foundation and the University of Minnesota's Retail Food Industry Center. The initial success of the research has led to a series of related projects and doctoral dissertations, as well as financial support from other organizations.

Stephen J. Smela received the John R. Borchert Fellowship, an award created by CURA to honor our first director. The fellowship is awarded annually to an advanced graduate student in geography for work on an issue of importance to the citizens of Minnesota. Selection for the award is made jointly by CURA and the Department of Geography.

Funding Available from CURA

■ The **Communiversity Program** funds quarter-time graduate student assistantships for one semester to help community-based nonprofit organizations or government agencies with a specific project. The application deadline for fall semester 2001 assistantships is June 28, 2001. For more information, contact Communiversity program manager Ed Drury by phone at (612) 625-6045, or by e-mail at drury001@umn.edu.

■ The **Graduate Interns for State Agencies Program** fosters opportunities for graduate students to work outside the University of Minnesota on research, program development, program evaluation, or other short-term projects for a state agency in Minnesota. The agency supervises the graduate assistant, and shares costs equally with CURA. Grants for 2001–2002 are for up to one academic year, and the application deadline is May 3l, 2001. Interested state agencies can contact program manager Ed Drury by phone at (612) 625-6045, or by e-mail at drury001@umn.edu.

■ The **Community Assistantship Program (CAP)** matches community-based nonprofit organizations, citizen groups, and government agencies in Greater Minnesota with students who can provide research assistance. Eligible organizations define a research project, submit an application, and if accepted, are matched with a qualified student to carry out the research. The deadline for applications for fall 2001 (September through December) is July 1, 2001. For more information, to discuss potential projects, or for assistance with applications, contact CAP coordinator Jan Joannides by phone at (612) 251-7304, or by e-mail at joann001@umn.edu.

■ **Neighborhood Planning for Community Revitalization (NPCR)** provides student research assistance to Minneapolis and St. Paul community organizations involved in neighborhood-based revitalization. Projects may include any issue relevant to a neighborhood's needs and interests, including planning, program development, or program evaluation. Priority is given to projects that support and involve residents of color. Applications from organizations collaborating on a project are encouraged. Applications are due July 10, 2001, for fall 2001 assistance. For more information, visit NPCR's website at http://www.npcr.org, or contact NPCR project director Kris Nelson by phone at (612) 625-1020, or by e-mail at nelso193@umn.edu.

■ The **University Neighborhood Network (UNN)** links community organizations to course-based neighborhood projects that students carry out as part of course requirements. For more information about support for course-based projects, visit UNN's website at http://www.unn.umn.edu, or contact UNN coordinator Karin Bolwahn by phone at (612) 625-0744, or by e-mail at unn@umn.edu.

2000 Population Distribution Maps

The state of Minnesota and Twin Cities area population distribution maps on pages 18 and 19 are based on 2000 U.S. Census data. Dots were plotted within each city or township across the state. Within the Twin Cities metropolitan area and for many cities in greater Minnesota, block data were used to allow more accurate placement of dots. Some manual adjustments were made to remove dots from lakes and parks, or to add dots where rounding errors would have eliminated them. In more remote areas of the state, dots may summarize a population scattered across a wide geographic area.

We are pleased to announce that four-color poster-sized versions (17 by 22 inches) of these maps have been created through a joint effort of CURA, Minnesota Planning (State Demographic Center and Land Management Information Service), and the Metropolitan Council. The wall map versions are printed back-to-back, and include county and city names, major water features, and selected major roads and highways.

CURA will ship up to two folded copies of the wall map free of charge, and will ship flat (unfolded) copies of the map for the cost of shipping and handling. To order, call (612) 625-1551 or send e-mail to cura@umn.edu. Please specify flat or folded copies and the quantity you would like to order, and include your complete mailing address and phone number. Allow 3–6 weeks for delivery. To obtain a free flat (unfolded) copy of the map, or for multiple folded copies, visit CURA during regular business hours at the University of Minnesota (West Bank), 330 HHH Center, 301—19th Avenue South, Minneapolis, MN 55455.

Wall maps can also be ordered from Minnesota Planning's Demographer's Helpline at (651) 296-2557 or helpline@mnplan.state.mn.us, the Land Management Information Center at (651) 296-1211, or the Metropolitan Council at (651) 602-1140 or by e-mail at data.center@metc.state.mn.us.

Neighborhood Environmental Inventories on the Internet: Creating a New Kind of Community Resource for Phillips Neighborhood

by Hilda Kurtz, Helga Leitner, Eric Sheppard, and Robert McMaster

Residents of inner-city neighborhoods and many communities around the country have become increasingly concerned about the environmental and social sustainability of the places in which they live. One tool that has been widely proposed for residents trying to monitor and address challenges to neighborhood sustainability is the neighborhood environmental inventory. In this article, we report on the results of a community-university partnership between the Department of Geography at the University of Minnesota and residents of the Phillips neighborhood in south Minneapolis. This research was funded by CURA and Neighborhood Planning for Community Revitalization (NPCR), with additional support from the National Science Foundation (grant SES-19990509).

Drawing on previous experiences using geographic information systems (GIS) to assess environmental justice in the Twin Cities (as documented in the September 1999 issue of the *CURA Reporter*), the goal of this community-university collaboration was to develop a GIS-based Phillips neighborhood environmental inventory that reflected residents' sustainability priorities, documented the challenges they face, and provided a community resource for neighborhood organizers and residents alike. The Phillips neighborhood was chosen for the project because the university partners involved had conducted previous work in Phillips through CURA's Neighborhood Planning for Community Revitalization program, and therefore had previous contacts in the neighborhood.

This research began at a time when formal neighborhood planning structures in Phillips were in abeyance because the People of Phillips neighborhood organization had lost the support of the city. Thus, the principal neighborhood partners involved in the project were Annie Young of the Green Institute, and Lonnie Nichols, director of the Phillips Neighborhood Environment and Transportation Committee (Phillips ETC). The Green Institute and Phillips ETC have long been involved with sustainability issues in south Minneapolis and the Phillips neighborhood, and both organizations wanted to develop an inventory of neighborhood conditions that would be useful for neighborhood organizations and residents working to improve the quality of life in the area.

Smith Foundry in southeast Phillips is the only company in the neighborhood listed in the Federal Toxic Release Inventory. Information on toxic chemicals stored and released here is available to neighborhood residents in their effort to monitor and reduce potential exposure to pollution.

The Phillips neighborhood is large and diverse, and local conditions vary substantially from one part of the neighborhood to another. The project partners were committed to capturing this diversity in the inventory. Thus, in contrast to neighborhood sustainability inventories that assign entire neighborhoods a single numerical score on a variety of measures, we sought to construct a series of maps that depicted how conditions affecting sustainability vary within the neighborhood itself.

Maps are powerful and accessible tools for illustrating how conditions differ across a neighborhood. Unlike large tables of data, maps can also communicate to neighborhood residents information about the environmental conditions around their homes, schools, and workplaces. GIS technologies were used to construct maps from data incorporated into the inventory, and the final results were made available on the Internet. In the remainder of this article, we provide background on the Phillips neighborhood, discuss how the inventory was constructed, explain why the inventory was placed on the Internet, suggest possible uses of the data available on the inventory website, and discuss the benefits to and limitations of this kind of community-university partnership.

The Phillips Neighborhood

Because any environmental inventory that reflects neighborhood perspectives must be shaped by the context of the place to be inventoried, it is important to summarize some salient characteristics of the Phillips neighborhood. Phillips is a racially diverse central city neighborhood, and the largest neighborhood in Minneapolis in both geographic area and population. Based on 1990 U.S. Census data, Phillips is more racially diverse, and has more immigrants, more children, and a more economically marginalized population than Minneapolis as a whole.[1] In 1990, more than half of neighborhood residents were members of racial minority groups (22% for Minneapolis), and 10% of the neighborhood population was foreign-born (6.2% for Minneapolis). An extraordinarily high percentage (33%) of neighborhood residents were children under age 18 (19.7% for Minneapolis), but the percentage of residents over age 65 (13%) approximated that for Minneapolis as a whole. Nearly 49% of the total population lived in poverty as defined by the U.S. Census (18.5% for Minneapolis), and 14.8% of the labor force in Phillips was unemployed in 1990 (4.1% for Minneapolis).

Although size, diversity, and poverty have often formed barriers to neighborhood organizing, the Phillips neighborhood has a long and successful history of activism. Active involvement of residents in neighborhood economic development and planning dates back to the 1970s, well before the Neighborhood Revitalization Program (NRP). Indeed, until it overreached itself in the late 1990s, People of Phillips—with broad participation by residents—successfully developed and implemented a Phillips NRP plan to improve the quality of life in the neighborhood. From 1981 to 1993, environmental activism catalyzed around resistance against city plans to locate a garbage transfer station in the neighborhood. The Green Institute grew out of this successful campaign. Since its inception in 1993, the institute has developed innovative recycling, reuse, and green development programs in the neighborhood, and has contributed to environmental debates outside the neighborhood.

[1] At the time of publication, 2000 U.S. Census data for the Phillips neighborhood were not yet available. Although the data presented here are now 10 years old, it is unlikely that the neighborhood-city differences noted here will change significantly once 2000 U.S. Census data are available.

Conceptualizing the Inventory: Sustainability and Environment

Building on their history of successful environmental activism, neighborhood residents articulated a vision for enhancing the sustainability of the neighborhood in the Phillips NRP plan, prepared for the City of Minneapolis in 1997. The NRP plan emphasized a decent and sustainable quality of life for the current and future generations of residents. Central features of this plan included coexistence with nature, rediscovery of community, respect for diversity, a self-reliant and environmentally sound economy, and meeting residents' housing needs.

Elements of this plan formed the starting point for the development of the neighborhood environmental inventory. Throughout the process, neighborhood partners emphasized that the indicators of environmental conditions that were to be included in the inventory should document not only concerns about environmental risks, such as exposure to toxic chemicals, but also desires for environmental amenities and improvements, such as new green spaces and bicycle lanes. They also urged that the neighborhood environment be conceptualized to include the physical environment (air, water, soil, wetlands, forests, plants, and animals) as well as the built environment (housing and transportation infrastructure) and the social environment (including education, cultural life, access to jobs, and the incidence of crime). This broader conceptualization of neighborhood environment is reflected in the list of neighborhood sustainability issues raised in the NRP plan: housing; economic development; culture, arts, and ethnicity; community safety; family health and well-being; and environment, parks, and transportation.

Using this neighborhood-based list of important elements of the urban environment as our template, our partnership identified five broad categories of information to include in the Phillips neighborhood environmental inventory:

1. potential and actual sources of pollution (through air, soil, and water)
2. urban greenspace (parks and gardens)
3. transportation and the built environment (e.g., roads, bus and bike routes, housing)
4. people (e.g., age, race, income)
5. social infrastructure (e.g., schools, churches, daycare centers, community centers)

Other categories, such as the neighborhood economy and cultural life, were excluded from the inventory because there were insufficient resources available to conduct the neighborhood surveys that would have been necessary to collect such information.

Conceptualizing the inventory involved determining not only its contents, but also the form the inventory would take. At the time, other neighborhoods in Minneapolis were pursuing a different approach and developing sustainability indicators with the assistance of the *Neighborhood Sustainability Indicators Guidebook* (1999). Published by the Crossroads Resource Center, this guidebook lists several different kinds of indicators that are useful for different purposes. *Data poetry indicators* are qualitative, place-based indicators that are perhaps best appreciated by neighborhood residents; *deep sustainability indicators* are quantitative indicators used to articulate long-term visions for neighborhood sustainability; *core indicators* are quantitative indicators used to compare neighborhoods' progress toward the ideal of sustainability; and *background indicators* are quantitative indicators used to describe the social, economic, and environmental context for neighborhood sustainability initiatives. With the exception of data poetry indicators, all of these indicators tend to take the form of a single number that summarizes the state of some aspect of the neighborhood environment.

Our approach differed from this model in two respects. First, the Phillips environmental inventory included primarily background indicators. Second, we deployed the background indicators at a smaller scale than the neighborhood as a whole. Instead of assigning single numbers to the entire neighborhood, we used maps to show both the distribution of a specific indicator across the entire neighborhood, and the relationship between different indicators within the same part of the neighborhood. We believe it is important to know, for example, not only how much greenspace exists overall within the neighborhood, but also where it is located, and whether all neighborhood residents have easy access to it. Likewise, it is important to know the precise location of environmental hazards within the neighborhood in order to know who is most at risk for toxic exposure. Maps that show locations and distributions of

both amenities and hazards allow residents to examine these issues across the neighborhood.

Given our approach and resource limitations, we sought to use data that had already been collected by city, state, and federal agencies (particularly the U.S. Census), and that were available at a geographic scale (or resolution) smaller than the level of the neighborhood. Based on data availability, we identified a set of fine-resolution sustainability indicators for each of the five categories of the physical, built, and social environment discussed above.

For each category in the inventory, we identified information to which we already had access, as well as information that we might be able to obtain. Our working group looked carefully at all of this information, and prioritized which of it to include. We included all information that could be obtained from others who were willing to share it. We excluded information that would have required us to organize field surveys of the neighborhood, that was too unreliable, or that would have compromised the privacy of neighborhood residents or neighborhood residents' priorities. Table 1 lists the final set of sustainability indicators included in the inventory.

Creating the Inventory as a Community Resource: Mapping and Distribution

Once georeferenced databases for each indicator in Table 1 had been compiled, checked for errors, and made consistent with one another, the university partners used GIS software to make maps of the data collected for the inventory. Specifically, GIS software was used to map census data according to the block groups (street block) for which these data were compiled, and to map the streets in the neighborhood classified by whether or not they have bus or bicycle routes. In addition, GIS address-matching capabilities were used to map the location of community gardens, parks, potential pollution sites, schools, daycare centers, and senior citizen residences. All locations were subsequently verified by going into the field.

Indicators in the people category, together with housing indicators from the transportation and built environment category, were drawn primarily from U.S. Census data at the block-group (street block) scale. These indicators were mapped as choropleth themes, which means that block groups were shaded different colors according to their relative values. The demographic or housing data formed the background, or base layer, for each map produced. Indicators from the social infrastructure category and potential sources of pollution category were mapped as individual points or dots superimposed on top of the choropleth data. Indicators from the transportation category and greenspace category were mapped as point, line, or small-area data. The inventory thus consisted of the computer databases containing the sustainability indicators, the software used to store and map the data, and the computers on which the inventory was kept.

Table 1. Indicators Included in the Phillips Neighborhood Environmental Inventory

Data Category	Indicators
Potential sources of pollution	Superfund sites Petrofund sites Voluntary Investigation and Cleanup (VIC) and Voluntary Petroleum Investigation and Cleanup (VPIC) sites 1996 and 1997 Toxic Release Inventory sites
Transportation and built environment	Metropolitan Transit routes Bicycle lanes and paths Median housing value Housing occupancy (owner/renter)
Greenspace	Community gardens Parks
People	Race Age Percentage unemployed Median household income
Social infrastructure	Schools Senior citizen residences Daycare facilities Shelters

Peaceful Patch, located in south-central Phillips, is one of 20 community gardens created and maintained by neighborhood residents. These gardens exemplify a resident-led effort, coordinated by Phillips ETC, to improve the green environment in the neighborhood.

We initially used MapInfo GIS software. This software is relatively user-friendly and inexpensive, two factors that were important to our goal of installing the databases and software on computers at the Green Institute in the Phillips neighborhood, where residents and organizers would be able to visit and make their own maps. Although the scope of the inventory was reduced at various times throughout the project, the variety and volume of data stored in the inventory posed real challenges to making it easily available to community residents. Our original plan to locate the inventory in the Phillips neighborhood required finding a place to store the databases and software, as well as training personnel to use them. A copy of MapInfo was purchased for this purpose, but the partnership was unable to identify a suitable location or to provide a training program.

Eventually, we decided to take advantage of recent advancements in interactive Internet mapping software to make the inventory more easily and

widely available to neighborhood residents and others. The university partners transferred the data to ArcView and ArcView Internet Mapper software, and converted the inventory into an Internet map server. This map server is physically located at the University of Minnesota, and can be accessed at http://www.geog2.umn.edu/mapserve/pneiweb/Pneinet/PNEI.html. The map server is also linked to the Phillips Neighborhood Network website at http://www.pnn.org. The inventory website includes a summary of how the inventory was created; a series of maps at block-group resolution highlighting two or more of the indicators in the inventory; and suggestions for how to read and use these maps. It is an interactive site that provides users a limited ability to modify the maps by viewing different themes (variables) and producing different combinations of variables on the maps.

Making the inventory available as an Internet map server has the advantage of making the maps and data available to anyone—particularly neighborhood organizations and residents—with Internet access at their office, home, school, or public library. The Internet map server has disadvantages as well. First, use of the inventory is limited to individuals and institutions with access to the Internet. Second, because the university partners decided which maps to display, as well as the parameters for interaction with the map data, individuals and community organizations do not directly control the data that are available to them.

Interpreting Maps: Making Sense of the Inventory

The maps available on the map server can be examined in different ways, and individuals are encouraged to use their own initiative and local knowledge in making sense of them. However, for those with little previous experience reading maps, we suggest three ways to look at each map. Users of the inventory are encouraged to examine (1) the geographical patterns of a single neighborhood indicator, (2) the relationships between two or more indicators, and (3) the sustainability indicators in the immediate vicinity of where they sleep or spend their waking hours in the neighborhood. We will illustrate these three ways of making sense of the maps using two examples taken from the inventory.

As our first example, consider the map shown in Figure 1. The map includes several neighborhood indicators, as well as geographic information such as neighborhood boundaries and the location of major and minor streets. Users of this map could examine the distribution of a single neighborhood indicator, such as non-white popula-

Figure 1. Environmental Inventory Polluters and Vulnerable Populations: Non-White Persons

Figure 2. Greenspaces and Transportation: Children

tions in Phillips, and discover which sections of the neighborhood have the highest proportions of people of color and which have the lowest. They could also identify the location of generators of hazardous chemicals using the map, and determine whether they are randomly distributed across the neighborhood or clustered in particular areas.

Alternatively, map users could examine the relationship between these two indicators. There has been much debate about whether people of color are more at risk for exposure to pollution in the United States than are white people. Although a rigorous analysis of whether exposure to pollution is racially biased requires more than a visual analysis, using this map, a preliminary test of the hypothesis could nonetheless be conducted for the Phillips neighborhood. Other vulnerable populations include the very young and the very old. Studying the proximity of daycare centers, schools, and senior citizens' residences to generators of hazardous chemicals could reveal the potential risks they face in the neighborhood.

Finally, neighborhood residents could use the map to determine whether they live close to a cluster of polluters or generators of hazardous waste. This might enable them to consider what can be done to reduce the hazards they and their neighbors may be exposed to.

The map shown in Figure 2 highlights other aspects of neighborhood sustainability, including access to parks and community gardens (many created through neighborhood initiatives) and access to bicycle paths and mass transit. The map shows that all neighborhood parks but one are located on bus routes, while relatively few community gardens are located on bus routes. The map also indicates that while both daycare centers and community gardens are distributed throughout the neighborhood, fewer than half of the daycare centers are within a one-block walk of a community garden. Approximately half of the community gardens are within two blocks of a bus route. The map also shows that relatively few daycare centers are located in those block groups with the highest percentages of children aged four and under in 1990.[2]

[2] At the time of publication, 2000 U.S. Census data for the Phillips neighborhood were not yet available. Because the data reported here are from the 1990 U.S. Census, the children referred to are no longer in this age group. It should be noted that the distribution of age cohorts in the neighborhood may have changed significantly in the intervening 10 years.

Learning from the Community-University Partnership

Community-university partnerships such as the one reported here have been proposed as one way to make GIS and other information technologies (and university expertise more generally) available to communities. Such partnerships have been recognized as important mechanisms for engaging in socially relevant problem-solving research, and also for providing a means by which university-based researchers can help to fill gaps in the resource base of community organizations by providing information, skills, and technological support. Our experiences with this partnership demonstrate some of this potential. The partnership was able to work collaboratively to create a potentially useful product for the Phillips neighborhood that reflects both neighborhood participants' perspectives and priorities, and university participants' expertise.

At the same time, community-university partnerships face many difficulties that can compromise success, and our experiences bear out this potential as well. Despite that all participants were active and learned to work with one another, collaborations were generally part time, and were tacked on to the already busy working lives of all of the project partners. This meant that progress often was intermittent, discussions often were not as extensive as we wished, and a division of labor developed within the partnership. Neighborhood partners were particularly responsible for conceptualizing the structure of the database, whereas university partners were responsible for the idea of a map-based inventory, the technical work of collecting the data, the decisions about which maps to make and how to draw them, and the design of the Internet map server.

Because the final product is closely dependent on the decisions that were made by the university partners, the lack of neighborhood participants' input in these decisions may compromise the utility of the inventory. In addition, limited financial support meant that the content of the inventory was restricted to previously collected information, and thus did not exploit the true depth of local knowledge and expertise in the Phillips neighborhood. Substantial time and effort from both neighborhood and university participants would be necessary to mitigate these difficulties, including time to meet intensively over a two-month period to develop and design the inventory, and time for neighborhood residents to undertake neighborhood surveys. Given the busy lives and low incomes of neighborhood participants, financial inducements to purchase time would likely be necessary.

Neighborhood partners consisted of a few individuals who were active in the neighborhood, rather than a broad spectrum of neighborhood residents. In addition, personnel changes at the Green Institute have, to date, precluded presentation of the results at a neighborhood meeting. Although our neighborhood partners are very active in environmental issues in Phillips, it remains to be seen whether the neighborhood as a whole will find this resource useful. In order to broaden neighborhood participation, it would be necessary to consult regularly with a broad base of residents at neighborhood meetings throughout the planning process. This would best be done when the neighborhood is already engaged in environmental planning or activism (in order to tap existing activities and enthusiasm), and when neighborhood political structures are stable and capable of supporting such consultations.

Finally, the goal of creating an inventory that the community could take ownership of once it was completed has been hampered by a lack of technical knowledge at the community level to run the software. Although the university partners in the project would prefer to delegate maintenance, redesign, and modification of the Internet map server to the neighborhood partners, it is unclear at present whether this is possible. For the inventory to become a useful resource for the Phillips neighborhood, such participation is essential. An effective inventory must be an active resource, one that reflects the diversity of residents' views, accounts for changing ideas and realities, and is updated regularly with new information of importance to the neighborhood. Only then will the inventory become a tool for empowering neighborhood residents and encouraging neighborhood-based discussions of environmental issues. Although enthusiasts with the requisite skills to maintain the inventory do exist in the neighborhood, it is not sustainable to rely on the volunteer time of a few individuals. In order to maintain the inventory, publicize its existence, and catalyze neighborhood participation in its further development, it would be necessary to pay inventory volunteers, and provide the necessary equipment and training for neighborhood residents or neighborhood organization staff.

Hilda Kurtz is assistant professor of geography at the University of Georgia, with a Ph.D. from the University of Minnesota. Her areas of expertise include environ-

Related Neighborhood Reports from CURA

Neighborhood Planning for Community Revitalization (NPCR) has supported the development of environmental profiles for three Twin Cities neighborhoods: Marcy Holmes and Columbia Park in Minneapolis, and the West Side community in St. Paul. The profiles provide a general overview of environmental regulation, and detailed overviews of pollution, sewer discharge, hazardous waste storage, toxic releases, chemical storage sites, contaminated sites, solid waste sites, superfund sites, noise pollution, and mosquito control. An assessment of natural resources is also included in each profile. Neighborhood organizations have used this information to create Good Neighborhood Agreements, develop plans to mitigate environmental hazards, and take advantage of natural assets in their neighborhoods.

Environmental profiles for the Marcy-Holmes neighborhood (report number NPCR1007 and NPCR1056), Columbia Park (NPCR1016), and the West Side (NPCR1063) can be ordered free of charge from NPCR's website at http://www.npcr.org. Simply follow the links for "Published Reports," "by subject," and "environment," then select the title of each report you would like to order and complete the online order form. Reports can also be ordered by contacting Vanessa Steele by phone at (612) 625-5584 or by e-mail at steel012@umn.edu.

mental justice, GIS, the politics of scale, and urban gardens.

Helga Leitner is professor of geography at the University of Minnesota. She has published widely on urban development policies, international migration, immigrant incorporation in cities, and the use of GIS in environmental justice analysis and community-based planning.

Eric Sheppard is professor of geography at the University of Minnesota, specializing in urban and regional development, economic geography, GIS and society, and spatial analysis.

Robert McMaster is professor of geography at the University of Minnesota. His areas of expertise include environmental risk assessment, GIS and environmental justice, spatial analysis, and public participation GIS.

The authors wish to thank Sarah Elwood, Sabrina Lau, Lonnie Nichols, and Annie Young, whose assistance and commitment to the partnership described in this report was essential to its success. The authors are grateful to CURA and the Green Institute for the material support that made this collaboration possible.

This study was supported by an interactive research grant from CURA and the Office of the Vice President for Research, University of Minnesota. Interactive research grants have been created to encourage University faculty to carry out research projects that involve significant issues of public policy for the state and that include interaction with community groups, agencies, or organizations in Minnesota. These grants are available to regular faculty members at the University of Minnesota, and are awarded annually on a competitive basis. Additional support was provided through a faculty research grant from Neighborhood Planning for Community Revitalization, and grant SES-19990509 from the National Science Foundation.

New Publications from CURA

A Social Justice Framework for Child Welfare: The Agenda for a New Century. Edited by Esther Wattenberg. 2001. CURA and the Center for Advanced Studies in Child Welfare. CURA 01-1. 88 pp. Free.

A summary of the proceedings of a symposium held on June 23, 2000, at the University of Minnesota's Earl Brown Continuing Education Center. The symposium focused on the relationship between social justice principles and the child welfare system for the 21st century. The proceedings include an historical overview of the child welfare system, reflections and commentary on the social justice/child welfare nexus, reports on challenges and crises in the child welfare system, a comparative analysis of child welfare in Britain and the United States, a panel discussion on child welfare, and reflections from the field on new directions in child welfare policy. To order, call the Center for Advanced Studies in Child Welfare at (612) 624-4231. This publication will soon be available online (PDF format) at http://ssw.che.umn.edu/cascw/.

CURA Research Reports on Underrepresented Groups: Reports Based on CURA Research Projects, 1968–2000. Prepared by Margaret R. Wolfe. 2001. Center for Urban and Regional Affairs. CURA 01-2. 38 pp. Free.

A bibliography of CURA research reports from 1968 to 2000 that focus on historically underrepresented groups. Entries are listed by date and are organized into the following categories: African Americans, American Indians, Asian Americans, Latinos, multicultural, aging/seniors, people with disabilities, and women. This publication was prepared for the University of Minnesota's Sesquicentennial Diversity Project, a University-wide effort to supplement University Archives' holdings of resources on diversity, multiculturalism, and underrepresented groups. As part of the project, a full report of activities at the University of Minnesota related to diversity and multiculturalism will be placed in University Archives later this year. To order, send e-mail (with complete mailing address) to cura@umn.edu or call (612) 625-1551.

CURA's Website Has New Look, Location, and Features

The Center for Urban and Regional Affairs has redesigned its website to include more information about CURA programs, projects, and publications, and to make it easier for visitors to locate the information they are looking for. Our new website is located at http://www.cura.umn.edu.

One of the most useful new features of the site is a searchable catalog of publications available from CURA. The online catalog contains bibliographic entries for more than 1,700 publications from CURA during the last 30 years on topics ranging from urban development, transportation, and the environment to education, economic development, and disadvantaged and underrepresented groups. Visitors can quickly locate CURA publications of interest to them, and can use the convenient shopping cart feature to order publications online. You can find CURA's online publications catalog at http://www.cura.umn.edu/search.html.

Look for more new features on our website in the coming months!

Credits

Photo on cover courtesy of the Metropolitan Council.

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Figure on page 14 prepared by Mori Studio. All other figures prepared by the Cartography Laboratory, Department of Geography, University of Minnesota.

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Project Awards

To keep our readers up-to-date about CURA projects, each issue of the *CURA Reporter* features a few capsule descriptions of new projects under way. The projects highlighted in this issue are made possible through the Neighborhood Planning for Community Revitalization (NPCR) program at CURA. The projects described here represent only a portion of those that will receive support from CURA and its partners during the coming year.

■ **Environmental Profile for Lind Bohanon.** Lind Bohanon Neighborhood Association has been servicing the neighborhood since 1997, and has been instrumental in the development of the Humboldt Greenway and the North Mississippi Interpretive Center. A student will help the association investigate environmental emissions in the neighborhood generated by the nearby Camden and Humboldt industrial areas. This research will inform decisions about the health and actions of residents.

■ **Cleveland Neighborhood Revitalization Program Evaluation.** The Cleveland Neighborhood Association (CNA) works to improve the quality of life for residents, and is currently focusing on resident concerns related to crime, safety, and economic development. CNA will receive assistance from a student to evaluate their Neighborhood Revitalization Program projects during phase one of program funding. A report and workshop will be offered to inform other neighborhoods about how to conduct similar evaluations.

■ **Assessing Successful Mixed-Use Development Models of Transit-Oriented Development.** The Hiawatha Corridor Neighborhood Alliance (HCNA) is a collaboration of 10 neighborhood organizations in south Minneapolis, all of which are adjacent to the proposed Hiawatha light-rail transit route. A student will assist HCNA by researching opportunities for mixed-use redevelopment (housing and retail/commercial) along the Hiawatha corridor, and investigating how similar communities have utilized mixed-use development. The research will help HCNA identify potential development opportunities in the area.

■ **Understanding and Supporting Our Diverse Community Project.** The Glendale Resident Organization (GRO) is a small, resident-based nonprofit organization in Minneapolis that helps community members access resources and become self-sufficient. GRO also serves as a liaison between residents and the Minneapolis Public Housing Authority. A student assistant will collect demographic information about the Glendale neighborhood, and interview residents to identify cultural assets and potential networks in the community. The information gathered will be used to inform community- and capacity-building activities in the neighborhood.

■ **Liberty Plaza Needs Assessment.** The Twin Cities Housing Development Corporation (TCHDC) is a nonprofit developer and owner of low-income and affordable housing in Minneapolis and St. Paul whose primary mission has been to help provide affordable housing for low- and moderate-income families in the Twin Cities. With assistance from a student, TCHDC will conduct a needs assessment of residents in Liberty Plaza that will investigate the social service and culturally specific needs of residents. The assessment will be used to help TCHDC better identify and serve residents in need.

■ **Affordable Housing Trends in the Summit-University Community.** The mission of the Rondo Community Land Trust is to creatively meet housing needs while preserving the economic and cultural diversity of the community. The Selby Area Community Development Corporation's mission is to bring together people and organizations with diverse backgrounds to enhance the quality of life for all of the area's residents. These two organizations are partnering to conduct a study of the trends in affordable and low-income housing in the Summit-University community by examining market values, single-family housing, homeownership programs, and demographic factors. Geographic information systems (GIS) technology will be used to illustrate trends. The project will contribute to these organizations' efforts to address housing issues in the area.

JOHN R. BORCHERT

In many ways, Regents Professor of Geography Emeritus John Borchert was CURA's Founding Father. He served as our first director from 1968 to 1976, and during that time he established much of the fundamental philosophy that CURA has followed ever since.

Some of John's philosophy was elaborated in the introduction to *CURA: The First Seven Years* (1975). He viewed CURA as "an addition to . . . a long-standing community service effort [at the University]. CURA's role is to sponsor projects which cross disciplinary and collegiate lines, address major problems in the wider community, coordinate university and community resources, stimulate new programs to make the University more responsive to community needs, and increase the constructive interaction between faculty, students, and persons dealing directly with major public problems."

John Borchert was the personification of what a great professor ought to be. He authored seminal reports for CURA on subjects as diverse as the economic impact of the Mall of America, patterns of public college enrollment, the changing demographics of Minnesota, the future of urban transportation, and land values and land use in the Upper Midwest. His scholarship was rich, creative, and careful. He taught everyone who came in contact with him. And he cared deeply about Minnesota and the Upper Midwest.

John died on March 30, 2001, at the age of 82, but his legacy at CURA is very much alive and well.

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CURA connects University faculty and students with the people and public institutions working on significant community issues in Minnesota. CURA helps:

- faculty and students produce more relevant research on critical issues
- students strengthen their education through practical experience
- government agencies and community organizations get the assistance they request
- the University of Minnesota fulfill its land grant and urban missions

The *CURA Reporter* is published quarterly to provide information about CURA projects and programs. This publication is available in alternate formats upon request.

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