CENTRAL INDIANA

CENTER FOR URBAN POLICY AND THE ENVIRONMENT

MARCH 2006

Indianapolis Study

Land Use Affects Crime Incidence

When most people try to explain why some places have higher crime rates than others, they focus on social differences between areas such as household income or family disruption. Others have suggested that the physical environment can influence crime. In particular, some studies have suggested that the way land is used can affect crime rates. For instance, bars, malls, and public high schools have been associated with higher crime.

To date, no research has systematically examined a variety of land uses and whether they are associated with higher or lower levels of crime. In this report, we use data from the city of Indianapolis to consider how and when land use and crime are related. Our goal is to identify which land uses are associated with which crimes, above and beyond the social factors that most others consider. Although the statistics presented here are relatively simple, they are confirmed by more sophisticated statistical analyses which are described in the text box on page 6.

This analysis suggests that land use and crime are related. The relation between land use and crime, however, depends on the type of land use, the kind of crime, and whether the area has high or low levels of unemployment, poverty, and family disruption.

The study of land use is important for two reasons. First, knowing how and when land use is related to crime can inform police managers on effective allocation of patrol resources. Second, knowledge of land use-crime relationships can help planners and developers find ways to minimize crime through intelligent development of land use.

This analysis uses data on crimes and land use for the Indianapolis Police Department (IPD) service area. This area was divided into 1,000-foot-square grid cells for the analyses. For more on the methodology employed, see the text box on page 6.

What Are the Patterns of Land Use in Indianapolis?

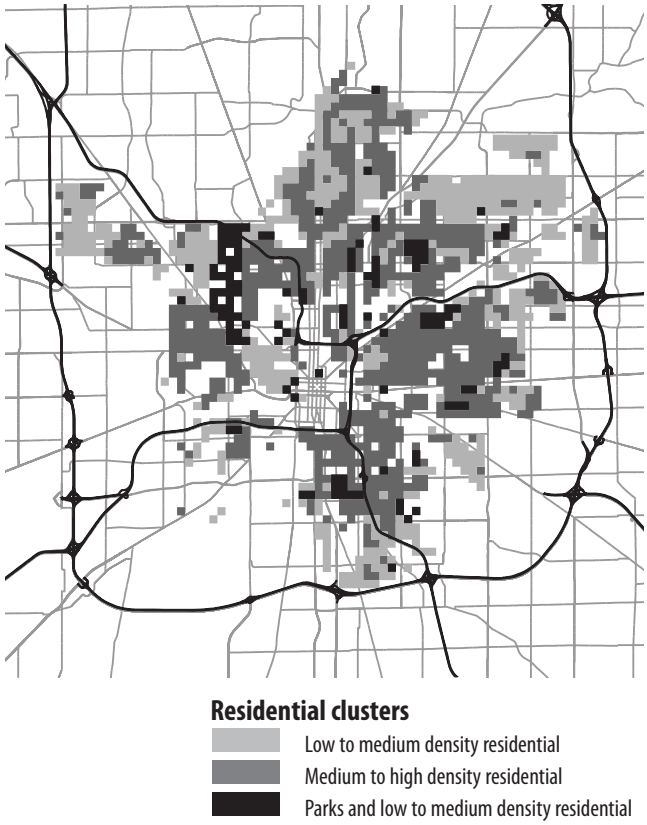
One strategy for analyzing the relationship between land use and crime is to identify particular patterns of land use. Types of land use tend to go together in relatively predictable ways. A statistical technique called *cluster analysis* allows us to determine which patterns of land use in the 1,000-foot-square grid cells tend to occur together.

Cluster analysis of more than 20 land use categories such as housing density, types of commercial activity, light and heavy industry, parks, schools, hospitals, and roads, produced six groups of cells with similar land use patterns in the IPD service area. Three clusters were primarily residential, and three were primarily non-residential.

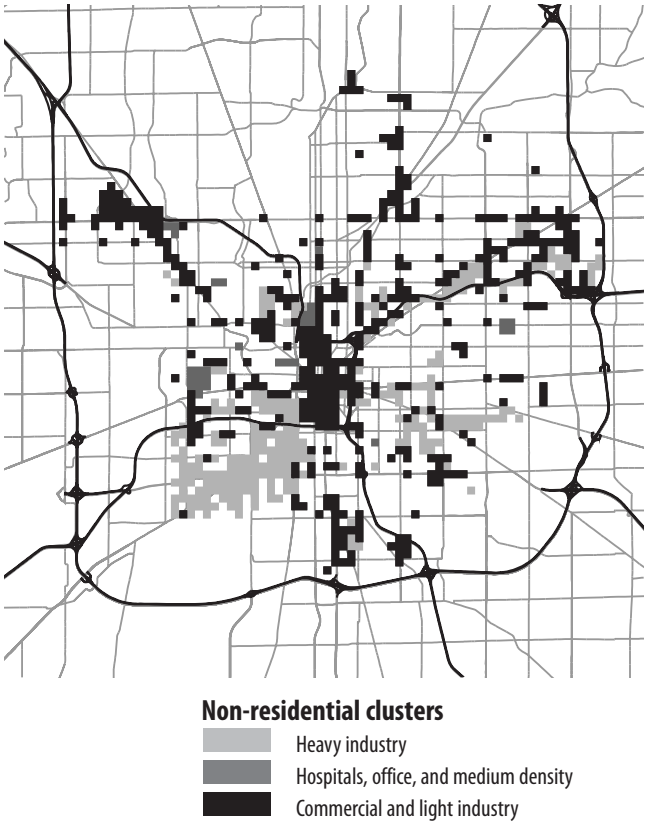
Maps 1 and 2 highlight the location and distribution of residential land uses and non-residential land use patterns respectively. One cluster of land uses includes predominantly low density residential housing. A second residential cluster consists mainly of medium to high density units. A third residential pattern combines low to medium density housing and parks.

In terms of non-residential land uses, one cluster seems to be dominated by commercial and light industrial areas. A second consists mainly of hospitals, offices, and medium-densi-

Map 1: **Land Use Clusters**



Map 2: **Land Use Clusters**



ty residential units. A third cluster is dominated by heavy industry.

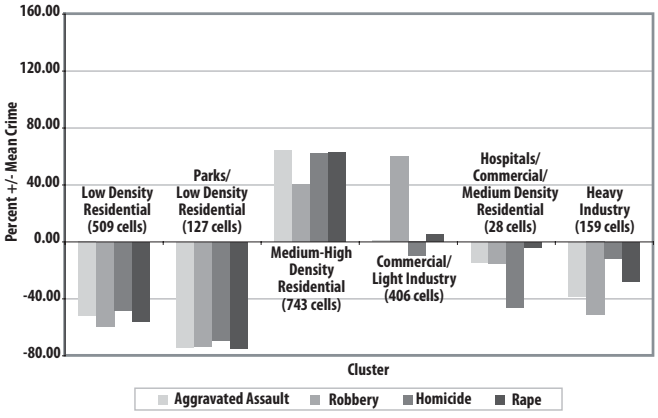
Do Certain Land Use Patterns Have Higher or Lower Levels of Crime?

We examined whether crime levels vary along with land use patterns. Figure 1 shows reported incidents of four violent crimes tracked by IPD, including homicide, robbery, serious (aggravated) assaults, and rape. The bars on the graph represent the departure from its overall mean for each type of crime in the entire IPD service area. Thus, the bars represent the degree to which a particular land use cluster is above or below the overall average for that particular crime.

Clearly, violent crime patterns vary across residential and non-residential land use patterns. Areas with predominantly low density residential housing are associated with violent crime levels that are 50 to 75 percent below the overall average. Areas with predominantly medium to high density housing are associated with violent crime levels that are 40 to 65 percent above average.

It is true that more people will, on average, live in the

Figure 1: **Crime Means Percentages by Cluster**



grid cells with higher density housing, providing both more potential criminals and more potential victims of crime. (This will not necessarily be the case for all grid cells as varying proportions of the land in the cells are used for non-residential uses.) In the more complex statistical analysis described in the text box, we controlled for this by considering population densities in the neighborhood of each grid cell. The estimates of the mean population densities in the medium to high density (cluster 3) grid cells are about 37 percent higher than in the low density (cluster 1) cells and about 58 percent higher than the parks/low density (cluster 2) cells. However, the levels of all types of crime are well over 100 percent higher in the medium to high density cells of cluster 3. Therefore, greater populations can only account for a fraction of the observed differences in crime levels across cells.

Interestingly, crime levels for areas that are dominated by retail, heavy commerce, and light industry depend on the specific crime. Robberies are 60 percent above the overall average in these areas, but homicide is below average, and rape and serious assaults are only slightly above average. Conversely, clusters with hospitals, offices, and heavy industry have below average levels of violent crime.

Does Housing Density Predict the Level of Crime in an Area?

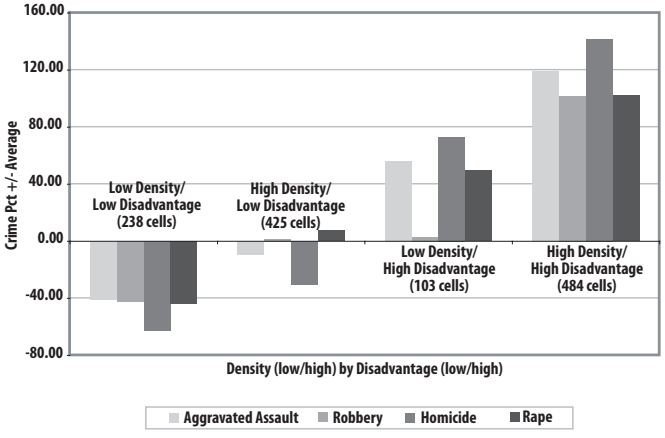
We examined variations in levels of reported crime associated with particular land uses, taking into account the socio-economic characteristics of the area. We noted before that the density of residential land use appears to be associated with the incidence of crime. Figure 2 probes this association further, showing the incidence of four violent crimes broken down into four categories of cells based on level of density and level of socio-economic disadvantage.

In Figure 2, low density housing refers to cells that contain only housing with fewer than 8 units per acre, whereas high density refers to cells that contain at least some housing with 8 or more units per acre (although these cells may also contain some areas with low density housing). Areas with 8 or more units per acre are predominantly multi-family housing units. Socio-economic disadvantage is a statistical index that includes percent unemployed, percent poor, and percent female-headed households. These three variables tend to be highly correlated. Therefore, cells with low scores on the index tend to be affluent with low unemployment, poverty, and marital disruption. Conversely, high-scoring cells tend to have high levels of these three variables.

In Figure 2, low disadvantage refers to more affluent cells with below average socio-economic disadvantage scores, and high disadvantage refers to cells with above average unemployment, poverty, and marital disruption. To make meaningful comparisons across cells, we restricted the analysis to include only the 1,250 cells with 100 or more residents. This minimizes differences in crime counts due to differences in the number of people living in particular areas.

Figure 2 shows that both housing density and socio-economic disadvantage are related to crime. The left two sets of bars refer to cells with below average levels of poverty, unemployment, and family disruption. Crime is well below the overall average when both density and disadvantage are low, but only slightly below average in socio-economically advantaged areas with high density housing. The right two sets of bars refer to cells with above average levels of disadvantage. Low density housing here is associated with elevated levels of crimes except robbery. Areas with high density housing in disadvantaged areas have much higher incidences of violent crimes. Thus, both density and disadvantage predict higher violent crime, but when the two are combined, violent crimes are especially high. This is likely because higher housing density increases the opportunities for crime, and socio-economic disadvantage increases the motivation for crime.

Figure 2: **Crime Means Density by Disadvantage**



Does Vacant Land Predict the Level of Crime in an Area?

Figure 3 shows a similar comparison of the impact of vacant land in areas correlated with their levels of socio-economic disadvantage. The left two sets of bars refer to more affluent cells with below average socio-economic disadvantage, whereas the right two sets of bars show crime levels for areas with above average levels of disadvantage (poverty, unemployment, and family disruption).

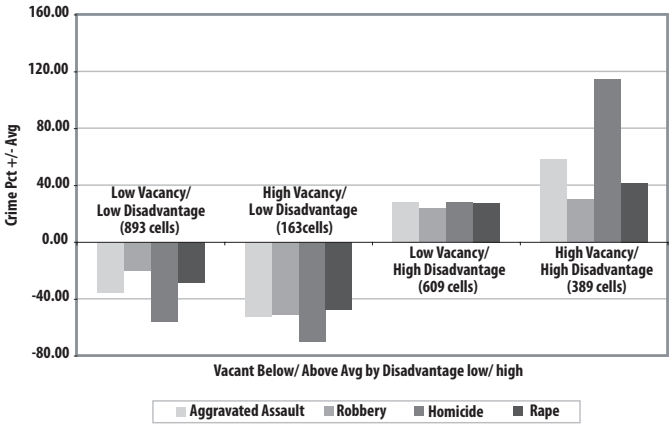
We also break vacant land levels down into below and above average amounts of vacant land per cell. Here again, the effect of vacant land on crime levels depends on whether the area is disadvantaged. Vacant land does not appear to increase crime in areas with low unemployment and poverty, but it is associated with much higher crime, especially homicide, in disadvantaged areas. Higher levels of vacant land can include abandoned housing, which could provide more opportunities for crime, explaining part of this effect.

Does Commercial Land Use Predict the Level of Crime in an Area?

We examined whether commercial activities were related to crime because commercial activity might increase the number of potential crime victims. Figure 4 shows crime levels by the presence of commercial land uses and disadvantage. Once again, we see that the relationship between land use and crime depends on the socio-economic standing of a particular area. The incidence of violent crime is lowest in cells with low rates of unemployment, poverty, and family disruption and no commercial land use. Both low disadvantage (affluent) cells with commercial land uses and high disadvantage cells with no commerce (the middle two sets of bars) are associated with nearly average crime levels.

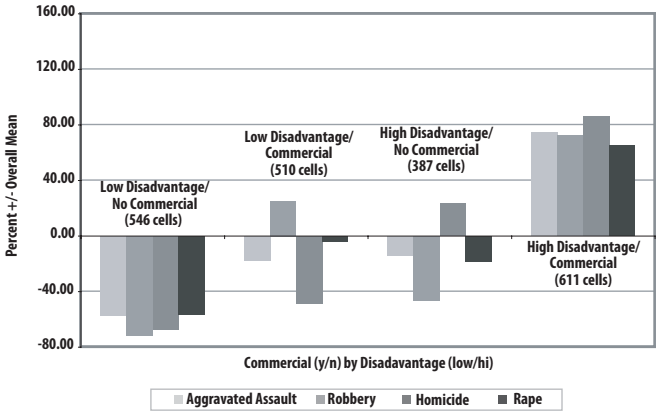
It is also interesting to note that homicide is lower in advantaged areas when commerce is present, but robbery is lower in disadvantaged areas when commerce is absent. The rightmost set of bars shows that areas with high levels of socio-economic disadvantage and commerce in the cell have violent crime levels that are 65 to 85 percent above average. Thus, the crime-producing effects of commercial land uses are especially pronounced in disadvantaged areas. This suggests the importance of law enforcement efforts targeted toward commercial areas, especially if the goal is to reduce robbery.

Figure 3: **Crime Means Percentages Vacant by Disadvantage**



Areas with high levels of both commerce and socio-economic disadvantage have violent crime levels that are 65 to 85 percent higher than average.

Figure 4: **Crime Means Commercial Percent by Disadvantage**



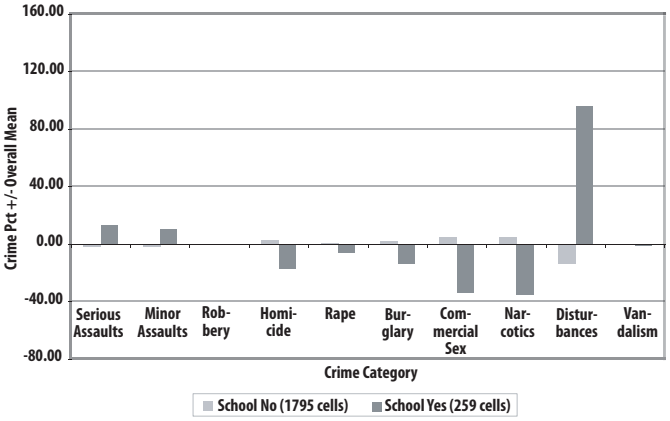
Do Schools Increase the Level of Crime in an Area?

Some have suggested that crime may be more frequent near schools. Figure 5 shows the incidence of crimes by whether or not a school is located in the cell. Generally schools do not appear to be magnets for crime. Homicide, rape, and robbery levels are average or lower in cells with schools. Schools also do not appear to be areas where commercial sex or narcotics trafficking occur with high frequency. Nor do schools seem to be associated with above average incidence of vandalism. Areas around schools also have somewhat lower levels of burglary. This could be because the areas near schools are high traffic areas during the day when many residential burglars operate. As a consequence, burglars may avoid these areas.

Schools do, however, seem to generate slightly higher (10 to 15 percent) levels of both serious and minor assault and much higher levels of incidents reported by officers as "disturbances," as opposed to any specific crime. This may be because of a perception that young people are loud or make trouble. Otherwise, crime levels are not much different, and in some cases lower, in cells with schools.

One limitation which must be noted is that we cannot distinguish between public and private; elementary, junior, and senior high schools; and institutions of higher education. It seems plausible that elementary schools do not generate large numbers of assaults, but future research should consider whether there are differences in crime reports by type and size of school.

Figure 5: **Crime Means by Schools**

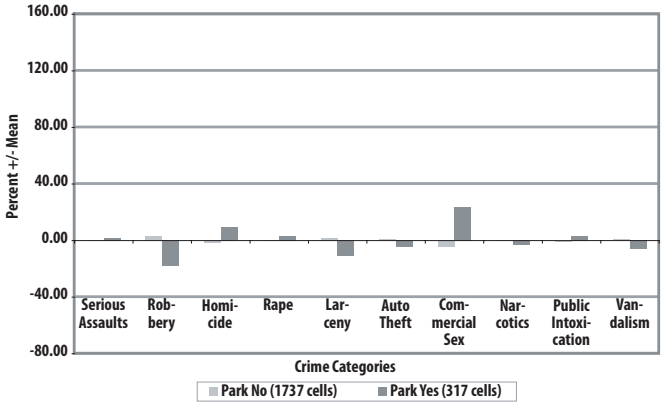


Narcotics sales and vandalism do not appear to be higher in cells with parks.

Does the Presence of Parks Increase the Level of Crime in an Area?

It is also reasonable to wonder whether parks are magnets for crime. Figure 6 shows the levels of some types of crime by presence or absence of a park in the cell. Generally, parks do not seem to attract large numbers of crimes. Homicides, rapes, and serious assault incidents are slightly above average, but larceny, motor vehicle theft, and robbery are below average in areas with parks. Perhaps not surprisingly, commercial sex and public intoxication are somewhat higher in cells with parks. This most likely reflects the lack of guardianship of these areas after dark, which makes them vulnerable areas for public nuisance offenses. Interestingly, however, narcotics sales and vandalism do not appear to be higher in cells with parks.

Figure 6: **Crime Means by Parks**

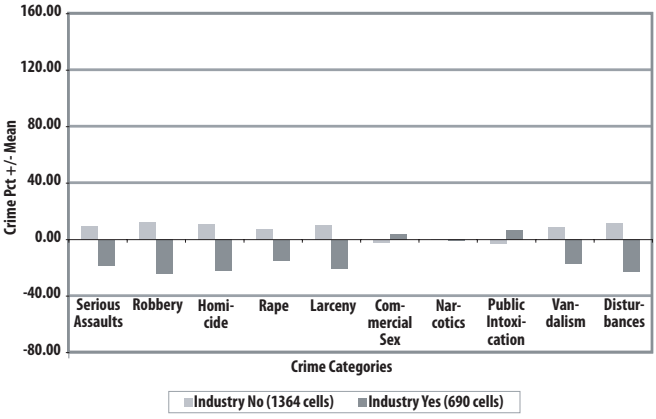


Do Industrial Areas Attract Crime?

We noted earlier that clusters of land use dominated by heavy industry have lower levels of violent crime. This continues to be true when we consider crime levels by the presence of all types of industry within cells. Figure 7 shows that all violent crimes are between 15 and 25 percent below their overall average in areas with industry. This is probably due in part to the lower population levels in these areas, which likely translates to fewer opportunities for violent crimes. Commercial sex and public intoxication are slightly higher in areas with industry, but illicit drug sales are not. Both vandalism and disturbances are also below average, which likely reflects fewer youthful residents engaging in these activities.

Clusters of land use dominated by heavy industry have lower levels of violent crime.

Figure 7: **Crime Means by Industry**



A Note about Methodology

This analysis uses data obtained from the Indianapolis Police Department (IPD), examining crime and land use in the IPD Service Area in the central portions of Marion County. The crime data are for 2003, and include the actual locations of violent crimes from the Uniform Crime Report dataset and the locations from officer incident reports for all other crimes. The land use data are for individual ownership parcels; these data were obtained from the Indianapolis Department of Metropolitan Development.

A system of 1,000-foot-square grid cells (2,142 cells) was used for the analysis. The numbers of the various types of crimes were determined for each grid cell from the IPD data. The percentage of the land in each grid cell in each of the reported land use classes was calculated from the land use data. Neighborhood socioeconomic characteristics are known to be associated with levels of criminal activity. For this analysis, various measures such as percent unemployed, percent poor, and percent of female-headed households were estimated for the areas within one-half mile of each grid cell using 2000 census block group data.

This report presents simple statistics on numbers of crimes associated with different types of land use, in a few cases also distinguishing low versus high levels of socio-economic disadvantage. We also used more sophisticated statistical analyses (Poisson regression) to simultaneously determine the effects of land use and neighborhood socioeconomic characteristics on crime. This allows us to observe the effect of land use on crime while controlling for socioeconomic factors. The descriptive results presented in this report are confirmed by these more sophisticated analyses.

If Land Use and Crime are Related, How Can We Use This Information?

This analysis suggests that land use and crime are related. The relationship between land use and crime, however, depends on the type of land use, the kind of crime, and the level of socio-economic disadvantage in an area. The effects on crime of residential housing density, commercial land use, and vacant land all depend on whether the area has high or low levels of unemployment, poverty, and family disruption. For example, the analyses found that all violent crime levels are lower in areas with low density housing. Conversely, areas with high density residential units have above average levels of serious violent crime, but violent crime levels are especially high in areas of both high housing density and high socio-economic disadvantage. Areas with schools have somewhat higher levels of assault, but not illicit drug sales, and, although they generally have less crime overall, industrial areas have higher levels of public intoxication and commercial sex.

Information learned from this type of study can allow police managers to focus their resources more effectively. For instance, public intoxication can lead to drunk driving. Therefore, if the goal is to reduce drunk driving, then enforcement efforts targeting industrial areas might make sense, because according to these findings, industrial areas generate disproportionately high incidents of public intoxication. Similarly, targeting commercial areas for robbery enforcement, especially in socio-economically disadvantaged areas could reduce crime.

Planners and developers could also use this information to minimize the crime-inducing effects of land uses. For example, developers and planners might want to consider the development of low-income housing at lower densities to reduce crime. Similarly, because areas of vacant land are associated with higher crime in disadvantaged areas, there is additional motivation to reduce abandoned housing and vacant land in these areas.

Thoughts for Policymakers

The analysis presented in this issue brief demonstrates that the study of land use in relation to crime incidence can contribute a great deal to the efforts of professionals in the law enforcement, planning, and land development fields. For example, knowing how and when land use is related to crime can inform police managers on effective allocation of patrol resources. Planners and developers can also use knowledge of land use-crime relationships to find ways to minimize crime through intelligent development of land use. State and local policymakers should consider these issues as they develop land use plans and allocate law enforcement resources in communities throughout Indiana.

CENTER FOR URBAN POLICY AND THE ENVIRONMENT

Central Indiana's Future: Understanding the Region and Identifying Choices

Central Indiana Region

Central Indiana's Future: Understanding the Region and Identifying Choices, funded by an award of general support from Lilly Endowment, Inc., is a research project that seeks to increase understanding of the region and to inform decision-makers about the array of options for improving quality of life for Central Indiana residents. Center for Urban Policy and the Environment faculty and staff, with other researchers from several universities, are working to understand how the broad range of investments made by households, governments, businesses, and nonprofit organizations within the Central Indiana region contribute to quality of life. The geographic scope of the project includes 44 counties in an integrated economic region identified by the U. S. Bureau of Economic Analysis.

The Center for Urban Policy and the Environment conducts ongoing studies on land use that are intended to strengthen public discussion and informed decision-making. This study combines research on land use, crime, and public safety, vital issues that affect quality of life in a community.

The Center for Urban Policy and the Environment is part of the School of Public and Environmental Affairs at Indiana University–Purdue University Indianapolis. For more information about the Central Indiana Project or the research reported here, contact the Center at 317-261-3000 or visit the Center's Web site at www.urbancenter.iupui.edu.

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