

THE AVAILABILITY OF LOCAL AERIAL PHOTOGRAPHY IN SOUTHERN CALIFORNIA

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PREFACE

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ABSTRACT

Aerial photography's potential as a primary data source for planning projects is increasingly being realized by local agencies. This report attempts to delineate a few of the major photography and photogrammetric suppliers and users located in Southern California. Also noted are recent trends in aerial photographic coverage of the Los Angeles basin area as well as the uses made of that imagery.

THE AVAILABILITY OF LOCAL AERIAL PHOTOGRAPHY IN SOUTHERN CALIFORNIA

Introduction

The importance of photography in urban problem solving is becoming more apparent to both public and private sector planner/engineers. Photography with its accurate record of existing conditions at a particular time offers a tool to various users unparalleled by any other form of recordation. Typical planning applications involving the use of aerial photographs include: base map preparation; bounding soil areas suitable for intensive development; lake surface area measurement; school site selection; change rate determination for underdeveloped to developed land uses; estimation of parked or moving automobiles in a city business district; and planning report illustration. Use of aerial photos in planning is becoming less limited due to their increasing quality, and greater emphasis on aerial photo usage is being placed in the training of planners.

LUMIS Description

The Land Use Management Information System (LUMIS) Project is based primarily on the use of aerial photos but also uses other, more traditional data routinely collected by governmental agencies. LUMIS is being developed by the Jet Propulsion Laboratory (JPL) on a test basis for the Los Angeles City portion of the Santa Monica Mountains. It will be designed in correspondence with two other land use information systems currently being constructed by Los Angeles City Staff.

The two City systems are LUPAMS (Land Use Planning and Management System) which is based on data recorded by the County Assessor's office for

each individual parcel of land in the city, and a second geographically based Environmental Data System (Geo-BEDS) which is based on US Census Bureau DIME file technology. The latter will incorporate numerous local, regional and federal data files at the first level of geographic aggregation -- the individual census block.

Input data for the LUMIS project will come from maps, aerial photographs, and satellite imagery and be complementary but not redundant to data being collected for use in the two City systems. A major goal in the LUMIS project will be the establishment of practical interfaces between the three systems that will insure users easy access to data for any specific geographic location at a resolution approximately equal to the individual city block.

Aerial Photo Survey Need

At the commencement of LUMIS project activities the staff was immediately confronted with locating appropriate aerial photography for the test area. Once this activity began it became apparent that prior to actual purchase and interpretation of imagery it would be necessary to determine what data items would be critical to users and at what scale and resolution these were needed.

To initially probe this question the staff attached two questionnaires (Appendix I and Appendix II) to the first LUMIS newsletter. This newsletter with attached questionnaires was circulated to a readership of approximately 200 persons.* Those readers in most cases were employees of educational, governmental, or other non-profit organizations. At the same time an intensive telephone survey was conducted of profit oriented aerial photography or photogrammetric firms within the Southern California region to determine what existing photos were available. This telephone survey was followed by actual field interviews of seven major aerial photo firms.

Questionnaire Survey Results

Nine organizations responded to the questionnaire titled, Aerial Photo Availability Survey for So. Calif. (Appendix I), and seventeen organizations to the second questionnaire titled, Survey of Land Use Planners and Managers Using or Interested In Using Aerial Photos (Appendix II). The results of the

*The newsletter distribution has since grown to over 350.

first questionnaire are shown in Appendix III and the results of the second questionnaire are shown in Appendix IV.

In looking at these results in Appendices III and IV, it can be seen that the largest users of aerial photography in Southern California, i. e. , Caltrans, the Community Analysis Bureau, Regional Planning, the County Engineer, Water Resources, UC Riverside, and VTN, Associates, all employ a great variety of cameras and film types depending upon the applications of each agency type. Black and white film tends to be used for larger scale, general reconnaissance or planning purposes with color infrared employed for smaller scale, environmental quality investigations; 9" x 9" format film still prevails. The RC cameras are the most favored. Most agencies are flexible in providing positive and negative prints or transparencies. Profit-making photogrammetric companies usually supply only positive prints or transparencies.

Most agencies fly only their areas of jurisdiction - for general planning they tend to minimize overlap for stereo purposes and ignore photogrammetric ground control. Thus with thirty percent or less of both side and end lap, precise orthophotos are available for only 20 percent of the coverage area. In contrast, photogrammetric companies flying for private developers and engineers requiring accurate map products will provide 50 to 60 percent overlap with ground-surveyed control points. Photos generally cost from \$7 to \$12 for small quantities - the price can drop to as low as \$1 each for large batches (several hundred).

Although the uses of air photos depend to a great extent on the agency's area of interest and concern, Appendix IV reveals the growing application of remote sensing in land use planning, environmental impact reporting, and transportation studies. Two very active civil engineering consulting companies, Dames and Moore and DMJM, are using air photos for environmental impact monitoring and resource analysis. CUNY (City University of New York) is attempting to link various data bases via remote sensing; a similar attempt to define census tracts from Earth Resources Technology Satellite (ERTS) imagery by James Wray of the U. S. Geological Survey has met with partial success.

Appendix V is a matrix summary of the field interviews and shows that in terms of frequency, aerial photography covering the entire Southern

California area has been taken by two or more firms. This includes Los Angeles and Orange counties as well as Ventura county, San Diego and San Bernardino counties on a yearly basis since 1967. According to the management of most of the firms represented in this report, this trend will continue for many years to come. Judging from the material reported in Appendix V there are presently negatives available for the entire Southern California basin for 1973. Many of the firms are presently preparing to take aerial photos for 1974, during the fall quarter.

Detailed Summary of Interviewed Firms

AERO SERVICE (LITTON INDUSTRIES)

Location:

390 North Alpine Drive
Beverly Hills, CA 90210
(213) 275-4523

Aero Service Corporation is a division of Litton Industries, active in world-wide aerial surveys for use in mapping and exploration projects by government and private enterprises. To accomplish its goals of world-wide coverage, the Aero Service Corporation is developed on a company group structure basis which includes such specialties as: Photogrammetric engineering, photographic and simulation systems, resources development, utility inventory mapping, side-looking airborne radar surveys and geophysical exploration surveys.

In order to provide these services for its patrons, Aero Services' assets include 20 aircraft, precision cameras, processors, printers and stereophotogrammetric equipment. This equipment, which includes precision aerial cameras, highly sensitive magnetometers and multispectral cameras, is continually up-dated to meet their needs with the highest degree of accuracy possible.

Aero Services has experience in the field of photogrammetry. In the photogrammetric cadastral and tax mapping field, Aero has mapped nearly 3,000,000 parcels for both municipal and county agencies. It also offers services in the field of geophysical exploration, radiometric data processing, employing the use of depth calculations independent of magnetic inclination,

extreme sensitivity to geologic sources within the section, even including multispectral photography which is yet another method of remote sensing.

Aero services is also interested in the fields of forest inventory, water exploration and analysis, agricultural development, area development, soils conservation, oil and mineral exploration and industrial planning.

AMERICAN AERIAL SURVEYS, INC.

Location:

564 South Stewart Drive
Covina, CA
(213) 331-5304

American Aerial Surveys, Inc., specializes in the field of photogrammetry and incorporates into its activities specialties such as vertical and oblique aerial photography, data reduction, strip topography and profiles to topographic mapping at all normal scales and contour intervals; photogrammetric cross sectioning - automatic digitizing; photo mosaics, general surveying and precise electronic distance measuring and many types of precision reduction work.

Each year, American Aerial Surveys takes aerial photos of the entire San Gabriel Valley, providing potential customers with up-to-date photos of the extensive Valley region. Its services are limited primarily to Los Angeles county although operating throughout the seven western states and Hawaii.

FAIRCHILD AEROMAPS, INC.

Location:

14437 North 73rd. Street
Scottsdale, Arizona (main office)
Antelope Valley, CA
(800) 528-7350 (602) 948-6160

Fairchild Aeromaps, Inc. operates out of Scottsdale, Arizona, and has done extensive work in the Los Angeles area. It has also done photogrammetric work in Arizona, Colorado, Kansas, Missouri, Nebraska, Nevada, New Mexico, Oklahoma, Texas, Utah, Wisconsin and Wyoming. The Fairchild company took photographs of the entire Los Angeles basin in 1973. Transparent copies of USGS maps (7 1/2' quads) are available from Fairchild which overlay most of their Los Angeles photography. Their Los Angeles photo pages are scaled 1:1,000 while the San Diego ones are scaled 1:1,200.

GEOSCIENCE

Location:

2330 Cherry Industrial Circle
Long Beach, CA 90805
(213) 630-4642

Geoscience Division of Geosource International Incorporated acquires its information on land use and resources through aerial photography, airborne remote sensing or client files. This method of obtaining information is effective because it enables the land planner or engineer and the land manager a chance to easily obtain information. The firm's primary involvement is in its specialized remote sensing and natural resource management systems, environmental monitoring, and environmental impact statement preparation. Geoscience is currently working on the Russian River Basin study and the Salinas River waste water project.

Geoscience, through its computerized land use and resources mapping systems, provides clientele with data acquisition, processing and interpretation by computerizing data through digitization if required. Through this system, Geoscience provides geometrically accurate maps and map statistics which are kept current. Map overlays are employed, also with the help of a computer driven digital plotter enabling trends to be illustrated by color coding information and data to be printed out at any desired scale.

The Geoscience computerized coordinate based system also has applications in fields such as land management, marketing, highway engineering ecology, and environmental monitoring. The system is used in these fields in conjunction with other computerized data and land analysis data. In these applications essential data are collected that are important in the management of natural resources such as agricultural resources through the identification of crops, measurement of field size and type, timing of cropping practices, and pre-planting and planting preparations. Other data collected are water resources through the classification of vegetation density, mapping of soil stoniness, ground water storage and its conditions, and timber resources through the classification of forest stands mapped by density, type and size categories, as well as identification of true plant species.

METREX MANAGEMENT CORPORATION

Location:

2118 West Colorado Blvd.
Los Angeles, CA 90041
(213) 254-6771 (213) 254-6167

Metrex Management Corporation uses photogrammetry to provide detailed information on land use in the greater Los Angeles area. They provide such information as: location of zone types, identification of transit routes, summaries of planning studies and multiple housing site studies, vacant land inventories, trade center locations and political boundaries demarcation. Metrex also provides information regarding real estate appraisals and assessment, location of industrial and preparation of redevelopment areas, census data, summaries of regional studies, and environmental impact reports.

It caters to governmental planners and private companies. Metrex stresses the importance of knowing what is involved in an area of business as regards access zoning and other site planning considerations. They also provide a zoning atlas for Los Angeles County which is updated biannually and includes aerial photos that inform the user of existing land use for a given site.

They are presently preparing an atlas of detailed census maps for the City of Los Angeles that conforms in scale and page size to their own zoning atlas and the City's emerging cadastral mapping system. This census map atlas is being prepared as the geographic reference document for use with the City's Geo-BEDS information system.

TELEDYNE GEOTRONICS

Location:

725 East Third Street
Long Beach, CA 92802
(213) 435-8326

Teledyne Geotronics is a service organization primarily engaged in aerial photography, geodetic surveying, analytical aerotriangulation, map compilation, and the development of related data for organizations desiring more complete information concerning the physical characteristics of the earth.

Related services include remote sensing, property mapping, positioning, digitizing, data plotting and volume determination. Most assignments involve

services for locating and designing highways, recreation sites, airports, conservation areas, military installations, reservoirs and dam sites. They are also involved in exploration and development, land planning and other civil engineering projects.

Teledyne's film library consists of over 300,000 aerial exposures covering major portions of the west including extensive coverage of California, Nevada, Arizona, Colorado, New Mexico, Oregon, Texas and Idaho. All photography is indexed by geographic location for easy access. The photography varies in scale and is dated from 1927 to the present. The majority of the photographs are vertical and provide stereoscopic coverage of the subject areas.

VTN (Photogrammetric Division)

Location:

(714) 687-3113 Newport Beach
(213) 781-1520 Van Nuys

VTN is a computer oriented, photogrammetric engineering and geodetic surveying organization. This firm provides the user with geodetic and field surveying services, controlled and semi-controlled photo mosaic maps, volumetric area and coordinate digitizing, aerial photography and high precision photo lab reproductions. The firm uses analytical aerotriangulation and cross section digitizing and has acquired the first Zeiss D-2 Planimat and Wild A-10 Autograph in the United States. VTN provides factual information including cost estimation for oblique and vertical photography, which can be produced using black and white, color (Kodak 2445) and color infrared (Kodak 8443) films. VTN has constructed controlled mosaics for the greater Los Angeles Basin, Orange County and portions of Riverside County.

Conclusions

The results of efforts to survey available photography for the greater Los Angeles area have been presented here. As such the activity represented was by no means exhaustive but rather was intended as an aid to LUMIS staff in seeking available imagery for their study area. The published findings are intended as a guide to other local researchers seeking sources of aerial photography as well as possible applications and no pretensions to this work being a complete summary or catalogue of such available photography in Southern California is made by LUMIS staff.

APPENDIX I

AERIAL PHOTO AVAILABILITY SURVEY FOR SOUTHERN CALIFORNIA:
SAMPLE QUESTIONNAIRE

Agency Data

1. Name of Contact Person _____
2. Title _____
3. Organization _____
4. Street Address _____
5. City _____ State _____ ZIP _____
6. Telephone _____ Area Code _____

Film Type

Format (9" x 9", 70 mm, 35, etc.)

Scale

Resolution

Vignetting

Exposure

Form (Positive Transparencies, Negatives, Prints)

Camera Orientation (Vertical – Oblique)

Camera Type

Filters

Date & Time

Altitude

Coverage (Flight Lines)

Overlap (Stereo Coverage)

Photogrammetric Controls

Indexing

Geographic Area Covered

Cost of Photos

APPENDIX II

SURVEY OF LAND USE PLANNERS AND MANAGERS USING OR
INTERESTED IN USING AERIAL PHOTOS

SAMPLE QUESTIONNAIRE

1. Name _____
2. Title _____
3. Organization _____
4. Street Address _____
5. City _____ State _____ ZIP _____
6. Types of Activities Involving the Use of Aerial Photos

7. Data Items Retrieved from Photos That Are Used in Land Use Planning and Managing

8. Data Items You Would Like to Have from Photos for Use in Land Use Planning and Managing

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APPENDIX III
RESULTS FROM APPENDIX I QUESTIONNAIRE

Organization	Film Type	Format	Scale	Resolution	Vignetting	Exposure	Form (Positive Transparencies, Negative, Prints)	Camera Orientation	Camera Type
1) Air Views 3822 Campus Drive Newport Beach, California 92660	Plus X Ektachrome Ektacolor Infrared	9" x 9" 35mm 7" x 7" 2-1/4 2-3/4 445	As requested	Depends on Altitude, Smog, etc.	Not computed	Various	Positive, Negative, Prints	Various	Lieca, F8 Linhoff, F56 K17, etc.
2) Caltrans 7 120 South Spring Street Los Angeles, California 90012	Varies with job conditions	9" x 9" (35 Available in Sacramento, California)	Mapping 1:250 Hiway Fwy Inventory at 1:200	Normally good	-	-	Positive Transparencies	Vertical	6", 12", 24"
3) City of Glendale, Planning Division 633 East Broadway Glendale, California 91205	Kodak Double X Aerographic Film 2405 (Estar Base)	9" x 9"	1" = 1,000'	-	-	Aerial Exposure Index 125	Negatives, Prints	Oblique	-
4) Community Analysis Bureau 200 North Main Street Room 1110 Los Angeles, California 90012	Kodak Color Infrared (Cir), Aerochrome Infrared Film 2443	9" x 9"	1:10,000	High Resolution 1 to 2 feet	Moderate	Good	Positive Transparencies	Vertical	Aerial Mapping Camera RC 70
5) Department of Regional Planning, County of Los Angeles 320 West Temple Street Room 1168 Los Angeles, California 90012	Various	Various	1:24,000 to 1:450,000	Various	-	-	Positive, Negative, Prints	Both	Various
6) Los Angeles County Engineer, Survey Division 108 West Second Street Room 402 Los Angeles, California 90012	Kodak 2405	9" x 9"	1" = ±100' to 1" = ±2,000'	Good to Excellent	No	-	Negatives and Prints, all black and white	Vertical	Wild RC 8, RC 10 (F=6")
7) State Department of Water Resources 849 South Broadway Los Angeles, California 90055	CSS, PMA	9" x 9"	1:24,000 to 1:200,000	-	-	-	Transparencies	Vertical (Color)	35mm Nikon
8) U. C. Riverside, Department of Earth Sciences Riverside, California 92502	-	-	1:10,000 to 1:130,000	Good to Excellent	-	-	Positive Transparencies	Vertical	RC 8, RC 10
9) VTN Consolidated, Incorporated 2301 Campus Drive Irvine, California 92664	Eastman Kodak Double X, #2405	9" x 9", 9" x 18"	Various scales: 1:24,000 to 1:48,000	Unknown	None	f8-1/375	All of the above plus enlargements	Vertical Oblique	Wild Heerburg, RC 10 (Wild Universal Aviagon on Lens)

Organization	Filters	Date and Time	Altitude	Coverage (Flight Lines)	Overlap (Stereo Coverage)	Photogrammetric Controls	Indexing	Geographical Area Covered	Cost of Photos	Comments
1) Air Views 3822 Campus Drive Newport Beach, California 92660	Various	Various	Various	As specified	60%	None	None	Various	10 x 10, B&W, \$10 8 x 10, B&W, \$ 7 10 x 10, color, \$20 8 x 10, color, \$12	Extensive file of aerial photos
2) Caltrans 7 120 South Spring Street Los Angeles, California 90012	As required	As required	Depends on job	1:200, 900 ft each side of roadway	55-65%	Set up for job requirements	Yes	District 7, Ventura-L. A., Orange Counties	\$15 min 5.50 per 9 x 18 Prints \$0.90 - \$2.00	--
3) City of Glendale, Planning Division 633 East Broadway Glendale, California 91205	--	08-31-70, 10 a. m. 12-11-72, 10 a. m. (Made by Aero Service)	--	--	--	--	--	08-31-70, City of Glendale including the Central City, North Glendale, the Verdugo Mountains and San Rafael Hills 12-11-72, North Glendale/ Montrose Area, including portions of the Verdugo Mountains and San Rafael Hills	--	--
4) Community Analysis Bureau 200 North Main Street, Room 110 Los Angeles, California 90012	Minus Blue	Spring & Fall, 1971	5,000 ft.	City of Los Angeles	60% forward lap 30% side lap	None	Yes	City of Los Angeles, Beverly Hills, Culver City, Santa Monica, Baldwin Hills, Inglewood	\$15,000 (total)	--
5) Department of Regional Planning, County of Los Angeles 320 West Temple Street Room 1168 Los Angeles, California 90012	Various	Various	Various	--	Stereo coverage for certain flights	--	--	Los Angeles County and Environments	--	--
6) Los Angeles County, Survey Division 108 West 2nd Street, Room 402 Los Angeles, California 90012	Haze	Various, usually at noon	Various, most 3000 ft above average ground	Los Angeles Basin & North County Various Los Angeles County	Los Angeles Basin not stereo, all others stereo	None for Los Angeles Basin photos, North County, and spot photos, yes	Yes, on U. S. G. S. quad sheets and photo indexes	Los Angeles County	Contact prints \$2.65 each	--
7) State Department of Water Resources 849 South Broadway Los Angeles, California 90055	--	Various	~5000 ft.	Ventura County - 1969 Orange County - 1970 Palos Verdes Valley & Winterhaven - 1973	--	None	--	Ventura County - 1969 Orange County - 1970	--	--
8) U. C. Riverside	--	--	Various	Southern California	30-60%	--	--	Southern California	Available for user applications	--
9) VTN Consolidated, Incorporated	Minus Blue Anti- Vignetting	Since 1966	Various	19 flight lines	30%-side lap 60%-forward lap	Some	In progress 07/14	Santa Monica Mountains and others	Varies	Extensive photos

APPENDIX IV
RESULTS FROM APPENDIX II QUESTIONNAIRE

Organization	Types of Activities Involving the Use of Aerial Photos	Data Items Retrieved from Photos that are Used in Land Use Planning and Managing	Data Items You Would Like from Photos for Use in Land Use Planning and Managing
1) Dames and Moore	Environmental Impact report preparation Site Feasibility studies Resource Analysis Mining Exploration, Land Planning	Land use categories, vegetation associations, geologic structures, drainage	---
2) State Parks and Recreation	Natural resource mapping and cultural resource mapping	Location of: Tree cover, grass cover, shrub cover, water bodies	Plus: Lakes, streams, rockout crops, cliffs, sand and all types of cover; percent of slope; areas of stable and unstable geology or soils; recreation use densities (especially beaches on busy weekends; monitor land usage relative to natural resource damage/enhancement.
3) California Division of Forestry	Fire control management and development of strategy on specific wildland fires as they occur - very limited use at this point in time	None	<ul style="list-style-type: none"> a) Identification and location of manageable top site class timber lands within the State. b) Identification and location of manageable grazing lands in the State with a carrying capacity separation. c) Identification and location of lands in the State with an extreme wildland fire hazard considering the fuel, slope and weather. d) Land ownership patterns and changes of ownership of those lands identified in the above factors: a, b, and c. e) Identification and location of lands from which forest products have been removed, and the volume removed, on scheduled intervals.
4) Community Analysis Bureau	Environmental surveys, housing quality analysis	Environmental data related to housing and residential area quality	---
5) Department of Urban Affairs	Community Analysis Program Economic Development Program Community Improvement Program	Housing characteristics, public and private facilities	---
6) University of California Riverside, Department Earth Science	Agricultural survey, environmental hazards, environmental survey/monitoring, water demand models, geomorphic analysis	"Extensive"	---
7) Culver City Planning Division	Land use and general plan studies, street patterns	Location of buildings on property	---

Organization	Types of Activities Involving the Use of Aerial Photos	Data Items Retrieved from Photos that are Used in Land Use Planning and Managing	Data Items You Would Like from Photos for Use in Land Use Planning and Managing
8) Department of Regional Planning - City of Los Angeles 320 West Temple Street Room 1168 Los Angeles, California 90012	Data gathering (resource surveys, land use, housing studies, etc.); Code and Ordinance Administration: Presentations and Orientation	Various	Various
9) Caltrans 7 120 South Spring Street Los Angeles, California 90012	Environmental/Transportation	All available information for inventory of change, condition, etc. in statewide system, regional analysis	---
10) State Department of Water Resources 849 South Broadway Los Angeles, California	Land use surveys/hydrologic studies	---	---
11) Transportation Planning LARTS Branch	Transportation Planning requiring detailed topography and land uses within specified corridor areas	Extent of urbanization; street patterns; natural growth; vacant land; man-made structures; topographic features pertinent to proposed alignment	Sufficient resolution to permit: a) Measurement of land areas and floor spaces b) Differentiate between land uses, particularly non-residential types c) Recognition of principal orientation features of civil and political divisions
12) City of Los Angeles Bureau of Engineering, Survey Division 108 West 2nd Street Room 402 Los Angeles, California 90012	Engineering Design and Engineering Display	Not available	---
13) Daniel, Mann, Johnson and Mendenhall (DMJM)	Urban and regional planning; land use studies; photo reconnaissance; map compilation and verification; photogrammetric materials takeoffs (removals, earthwork, etc.); project route studies	Facilities location; gross land use (apparent) crop type; irrigation patterns, transportation systems locations; apparent geological features; vegetation (type and location)	State coordinate system; land subdivisions (township, sections, major parcels); undivided land grant parcels, elevation data for prominent features, other land subdivisions; census tract boundaries, special district boundaries.
14) Caltrans (Sacramento)	Transportation systems planning; Impact analysis and modeling	Land use urban and rural	Land use location and acreage agricultural (suitability), vegetation, facilities inventory, geologic hazards, flood plains, riparian areas.
15) City of Glendale, Planning Division 633 East Broadway Glendale, California 9120	Land use planning activities: Land use element, seismic element, open space and conservation, subdivision control, environmental impact evaluation	Topography, vegetation, development siting	---

Organization	Types of Activities Involving the Use of Aerial Photos	Data Items Retrieved from Photos that are Used in Land Use Planning and Managing	Data Items You Would Like from Photos for Use in Land Use Planning and Managing
16) Los Angeles County Sanitation District	Topographic maps; site studies; area studies	Topography for site volume calculations; site drainage and access information; development in areas surrounding sites	Access to most current verticals or obliques of general areas of existing landfills and sites under study.
17) Department of Water Resources 849 South Broadway Los Angeles, California 90055	Land and water use studies, surveys, and inventory procedures	Irrigated and non-irrigated agriculture, several urban classes and native vegetation and under-developed land categories	As enumerated in LUMIS proposed list.
18) City University of New York	Link of census areas, voting districts, and other special interest areas to common base	Industrial, residential, commercial and recreational proximity	Sheet patterns, land use patterns, common landmark locating for linking data

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