Construction Economics Research Network
Washington, D.C.

Forecasting Construction Labor Demand: A Working Model?

Ralph Gentile
McGraw-Hill Construction
Research and Analytics
December 6, 2007

Perspective -- Creating a Skilled Trades Forecast

- McGraw-Hill Construction collects data on projects in planning, following those projects until they are abandoned or start. Projects that start are entered into a contract awards database
- McGraw-Hill Construction Research and Analytics produces detailed construction forecasts, primarily for building products manufacturers to help them analyze and plan for their markets.
- A natural extension is to use the same forecasts to help contractors and unions assess demand for the skilled trades.

Examples of Current Labor Demand Forecasts

- Bureau of Labor Occupational Employment Outlook
- Employment Development Departments (California and selected states)
- Construction Labor Research Council
- Construction Sector Council (Canada) Construction Labour Market Information (LMI) Program

Objectives:

- Find a way of estimating utilization rates by building type for the skilled trades so that different types of construction activity create distinct demand profiles for the the trades
- Adapt US utilization rates to regional or local economies
- Allow for the volatile nature of construction activity so that demand for the trades rise and fall quickly and significantly

First Objective:

Find a way of estimating utilization rates for the skilled trades by building type so that different types of construction activity create differing demand profiles for the the trades

Approach:

- Combine information from various sources to create a national utilization rate table. These sources are --
- Occupational Employment Surveys – which provide information on skilled trade jobs by NAICS industry at the national level
- Census of Construction – which supplies information about the output of NAICS industries by building type for the nation

Occupational Employment Surveys

- Provide employment, wages, and wage rates for 800 standard occupation classifications, including 58 in the skilled construction trades, (i.e, carpenters, roofers, electricians, carpenters helpers, etc.).
  - Based on establishments with payroll
  - Surveys conducted once a year (previously twice a year) based on a rolling sample
  - Cross industry-occupation surveys available at national level only

Census of Construction Industries

- Provides detailed statistics on U.S. construction activity, building products and labor inputs for thirty NAICS industries
- Classifies all employees of an establishment in that establishment's industry, no matter what the employees' occupations.
- Conducted every five years with results published about three years later (2002 Census most recent).
- Covers firms with payroll.
- Thirty construction industries divided into three sectors
  - Building Contractors (six industries)
  - Heavy/Engineering Contractors (six industries)
  - Specialty Trade Contractors (eighteen industries)

Examples of Census of Construction Industries

- Building Construction (Six in total)
  - New Single Family Construction General Contractors (NAICS 231665)
  - New Housing Operative Builders
- Special Trades Construction (Eighteen in total)
  - Poured Concrete Foundation & Structure Contractors (NAICS 238110)
  - Structural Steel and Precast Concrete Contractors (NAICS 238120)
- Heavy & Civil Engineering Construction (Six in total)
  - Water & Sewer Lines & Plants (NAICS 236115)
  - Power & Communications Lines & Related Structures (NAICS 237130)

Skilled Trades by Industry

(US Wages by Industry, Millions of Dollars, 2002)

	building construction industries			heavy construction industries		crafts & specialty trades industries			
Skilled trades	home builders	commercial/ industrial builders	.	highway builders	.	framing contractor	masonry contractors	.	totals
boilermakers	7	250	.	2	.	24	44	.	771
brick masons	79	364	.	12	.	20	3,335	.	4,443
carpenters	4,125	5,115	.	691	.	1,825	96	.	26,742
electricians	64	392	.	26	.	5	0	.	18,856
.	.	.	.	.	.	.	.	.	.
construction laborers	1,071	2,981	.	3,079	.	289	996	.	20,546
carpenters - helpers	374	383	.	38	.	134	0	.	2,079
.	.	.	.	.	.	.	.	.	.
construction wages	6,594	12,850	.	8,059	.	3,515	5,801	.	147,647

Construction Industry Output by Building Type
(in Millions of Dollars)

From 2002 Census of Construction Industries

	building construction industries			heavy construction industries		crafts & specialty trades industries			
Building types	home builders	commercial/ industrial builders	.	highway builders	.	framing contractor	masonry contractors	.	totals
.			.		.			.	
stores	302	38,547	.	88	.	339	96	.	58,798
offices	317	46,451	.	99	.	328	0	.	74,289
.			.		.	.	.	.	.
schools	634	41,041	.	220	.	134	0	.	68,975
hospitals	241	22,985	.	84	.	249	996	.	35,231
.	.	.	.	.	.	.	.	.	.
highways	56	1,058	.	46,136	.	3	72	.	55,721
drinking water	35	487	.	1,622	.	2	5,801	.	18,511
.			.		.			.	.
total construction	96,018	229,137	.	68,974	.	14,117	18,053	.	1,061,147

Carpenters' Contribution to Store Construction

(US Totals, in Millions of Dollars, 2002)

Construction Industries	wages paid to carpenters	stores as proportion of industry output	carpenters wages for store construction
homebuilders	4,125	0.3%	12
.	.	.	.
commercial/institutional builders	5,115	16.8%	859
.	.	.	.
.	.	.	.
highway builders	691	0.1%	1
.	.	.	.
.	.	.	.
framing contractors	1,825	2.8%	51
masonry contractors	96	7.2%	7
.			
.	.	.	.
total	$ 26,742	6.1%	$ 1,619

Skilled Trades by Building Type

(US Wages by Industry & Building Type, Millions of Dollars, 2002)

	Building types								
Skilled trades	stores	offices		schools	hospitals		highways	drinking water	totals
boilermakers	77	93	.	91	46	.	19	23	771
brick masons	335	343	.	608	182	.	52	39	4,443
carpenters	1,619	2,156	.	1,959	935	.	770	208	26,742
electricians	1,982	3,320	.	1,975	1,292	.	666	151	18,856
.	.	.	.	.	.	.	.	.	.
construction laborers	1,110	1,222	.	1,358	617	.	2,955	848	20,546
carpenters - helpers	119	153	.	234	68	.	51	15	2,079
.	.	.	.	.	.	.	.	.	.
construction wages	10,302	14,305	.	1,263	6,221	.	9,409	2,963	147,647

Skilled Trades by Building Type

(US Table, Percentages of Total Construction Cost, 2002)

	Building types								
Skilled trades	stores	offices		schools	hospitals		highways	drinking water	totals
boilermakers	0.1%	0.1%	.	0.1%	0.1%	.	0.0%	0.1%	0.1%
brick masons	0.6%	0.5%	.	0.9%	0.5%	.	0.1%	0.2%	0.4%
carpenters	2.8%	2.9%	.	2.8%	2.7%	.	1.4%	1.1%	2.5%
electricians	3.4%	4.5%	.	2.9%	3.7%	.	1.2%	0.8%	1.8%
.	.	.	.	.	.	.	.	.	.
construction laborers	1.9%	1.6%	.	2.0%	1.8%	.	5.3%	4.6%	1.9%
carpenters - helpers	0.2%	0.2%	.	0.3%	0.2%	.	0.1%	0.1%	0.2%
.	.	.	.	.	.	.	.	.	.
total	17.5%	19.3%	.	18.3%	17.7%	.	16.9%	16.0%	13.9%

Second Objective:

Modify demand estimates for the skilled trades for local and regional differences in building practice.

Approach:

- Use a combination of U.S. and McGraw-Hill Construction data to adjust national utilization rates to the local levels
- Occupational Employment Surveys provide skilled trade jobs for states and metropolitan areas
- McGraw-Hill Construction Contract Awards provide detailed construction contract awards by building type for state and local geographies

Rebalancing Tables

- **Well-established and widely used technique to adjust matrix for new information.**
- **Scales individual entries in the table to new row and column totals, adjusting the pattern of relationships among individual entries.**
- **Appropriate Uses --**
  - Adjust national rates for regional differences, for example higher usage of bricklayers in the southeast.
  - Force tables with older data, for example Census of Construction (2002), to conform to newer employment and construction data.

Data for Rebalancing Table

- Occupational Employment Survey data for states and large metropolitan areas for most recent historical years.
- McGraw-Hill Construction construction activity for counties summed to states and large metropolitan areas for most recent historical years.
- Result: a new skilled trades potential table configured for relevant geography and year *and* scaled to construction activity.

Rebalanced Table -- New Jersey Skilled Trades by Building Type

(NJ Wages, Percentages of NJ Construction Cost, 2002, scaled)

	Building types								
Skilled trades	stores	offices		schools	hospitals		highways	drinking water	simple average
boilermakers	0.1%	0.1%	.	0.1%	0.1%	.	0.0%	0.2%	0.1%
brick masons	0.6%	0.4%	.	0.9%	0.5%	.	0.1%	0.3%	0.7%
carpenters	3.2%	2.8%	.	3.3%	3.0%	.	1.7%	1.6%	3.9%
electricians	5.7%	6.7%	.	5.2%	7.0%	.	2.3%	1.8%	6.0%
.	.	.	.	.	.	.	.	.	.
construction laborers	2.1%	1.6%	.	2.4%	2.0%	.	6.8%	6.9%	4.6%
carpenters - helpers	0.1%	0.1%	.	0.2%	0.1%	.	0.1%	0.1%	0.2%
.	.	.	.	.	.	.	.	.	.
total	20.3%	20.3%	.	22.6%	21.0%	.	23.4%	28.3%	20.7%

- **<u>Third Objective:</u> Create a construction forecast that allows for the volatile nature of construction activity and includes detailed information about large projects in the planning stages**

- **<u>Approach:</u> Develop a consistent multi-level construction forecast by**
  - Creating a national economic forecast and flowing the results to regions, states and metropolitan areas
  - Applying construction models to regional, state, and metropolitan areas to forecast construction activity for twenty-two building types
  - Incorporating large project forecasts and using them to push state and metropolitan forecasts down to the county level

McGraw-Hill Construction Forecast

Project types:

Commercial: Stores, warehouses, offices, hotels, garages/service

- **Institutional**: Healthcare, education, dormitories, amusement, religious, miscellaneous nonresidential
- **Public:** Prisons, capitols and courthouse, public safety buildings
- **Residential**: Single family, multifamily housing
- **Heavy & Highway**: Streets/highways, bridges, sewers, water supply, dams/water resources, miscellaneous transportation, manufacturing, utilities

McGraw-Hill Construction Forecast

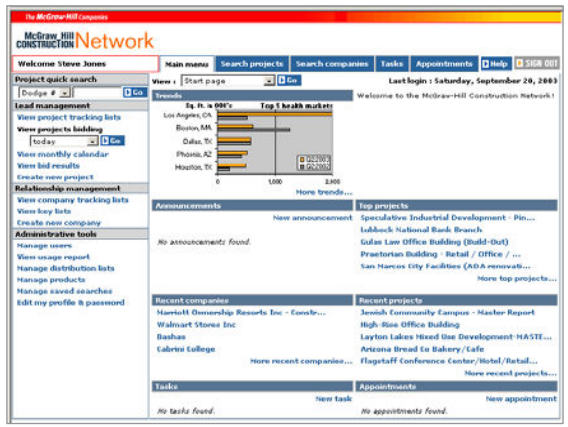
Methods:

- Models based on a comprehensive historical database available, updated quarterly
- Econometric models for 22 major project types at the national and regional levels
- State and metropolitan area models with share-down methodology for counties
- Expertise in determining
  - the percentage of planning/bidding projects that will ultimately reach start (within 5 years), and
  - the length of time to start for projects in prior stages of development

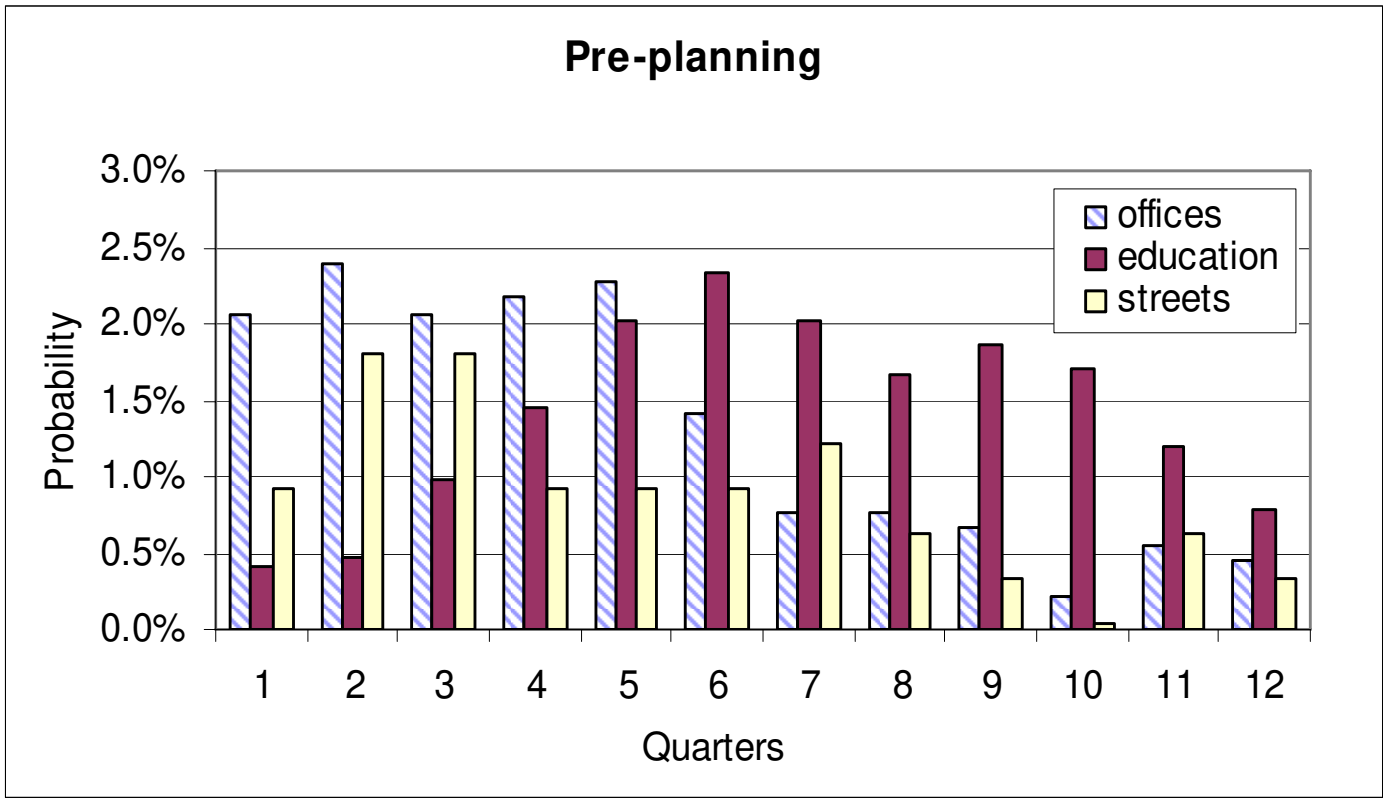
Incorporating Individual Projects

McGraw Hill CONSTRUCTION Dodge

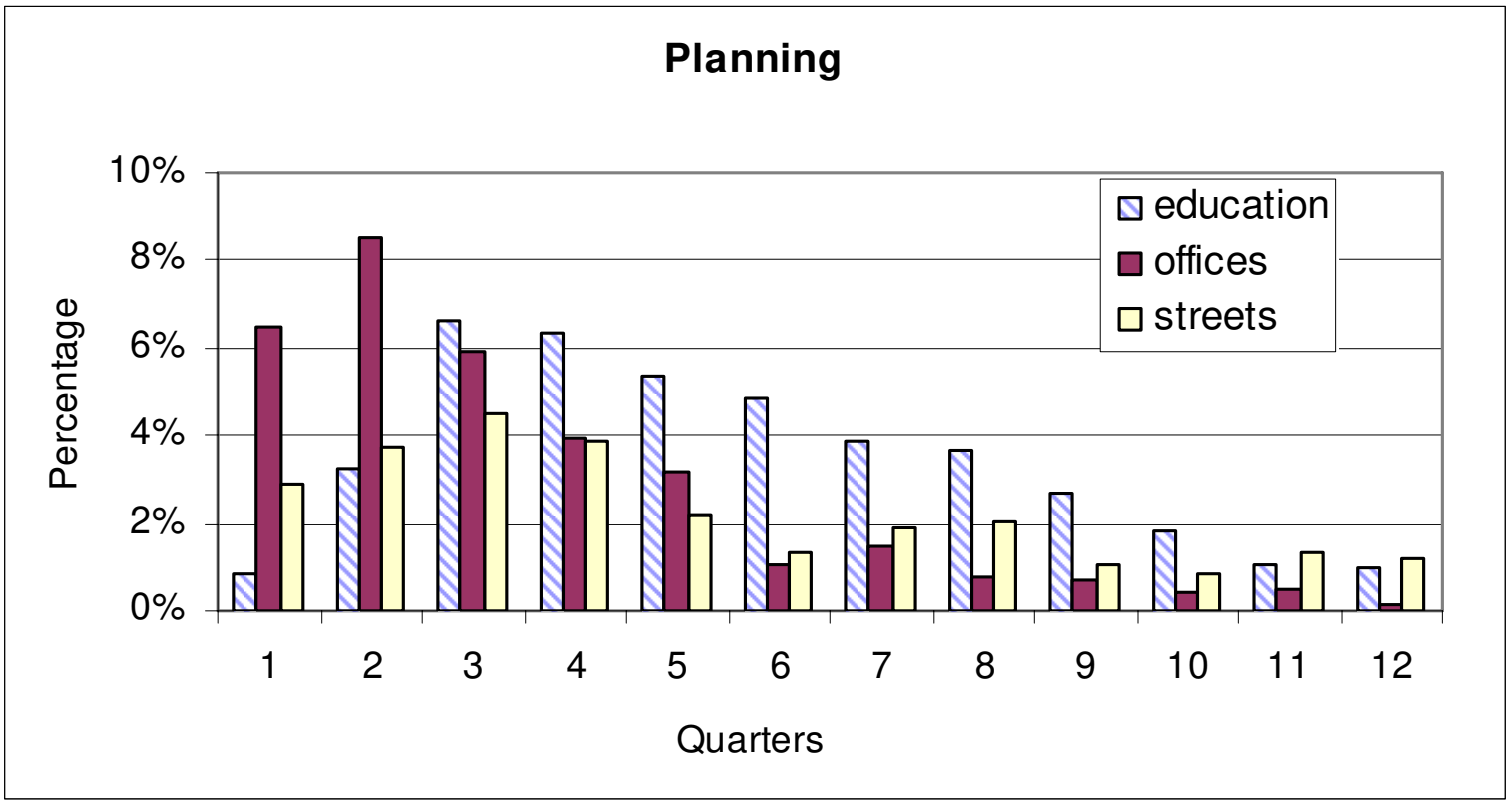
- Collect projects in the various planning stages from Dodge Reports and the MHC Construction Network
- Project those projects to construction start
- Reconcile projects with state and metropolitan level forecasts



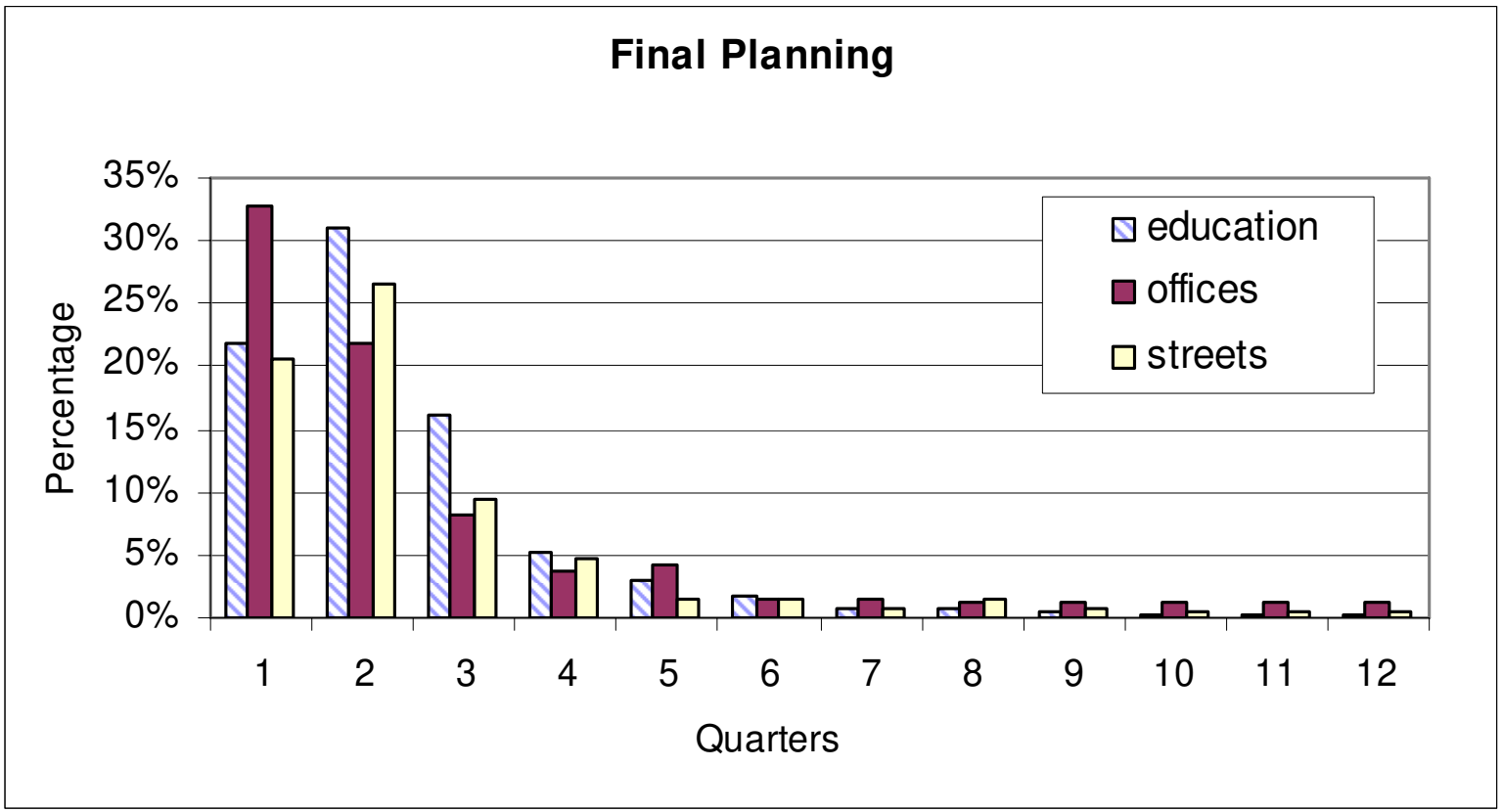
Time Lags and Probabilities Between Planning and Construction Start



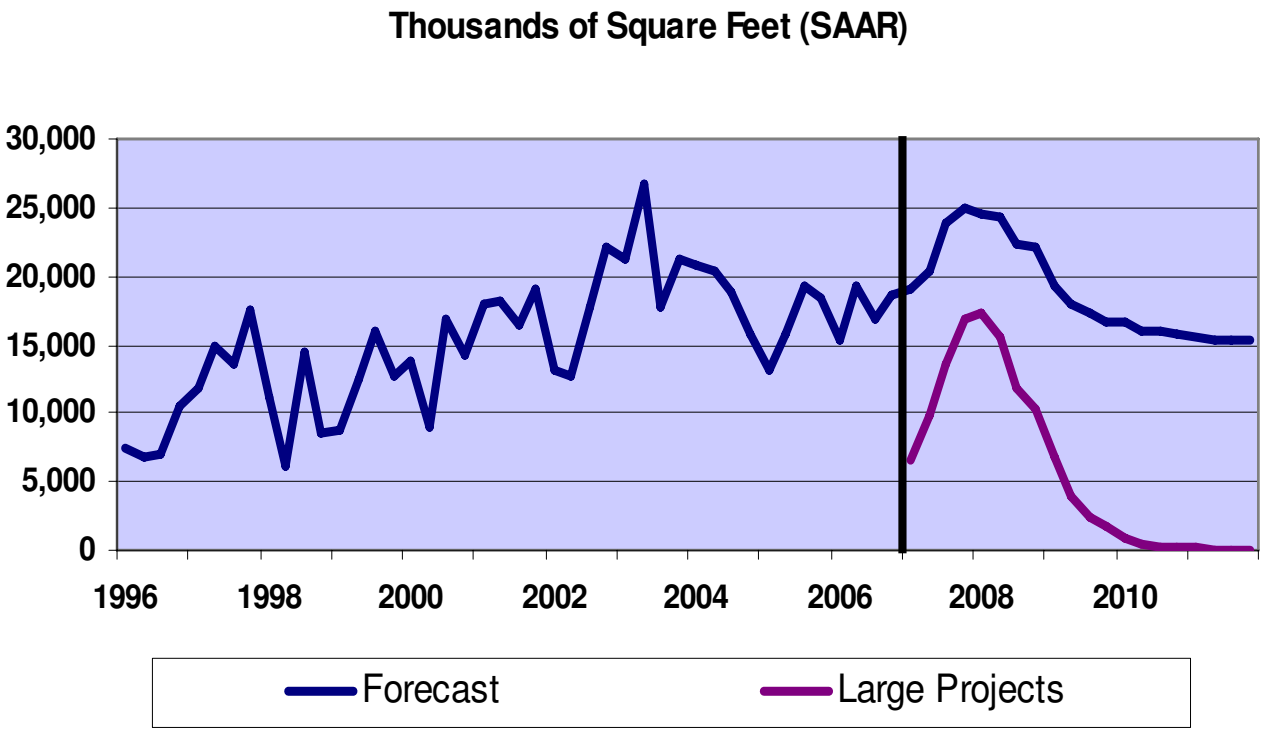
Time Lags and Probabilities Between Planning and Construction Start



Time Lags and Probabilities Between Planning and Construction Start



Forecast Detail
Education Buildings in California



Forecasting Demand for the Building Trades for the Midwest – An Example

Building Trades Outlook: Midwest

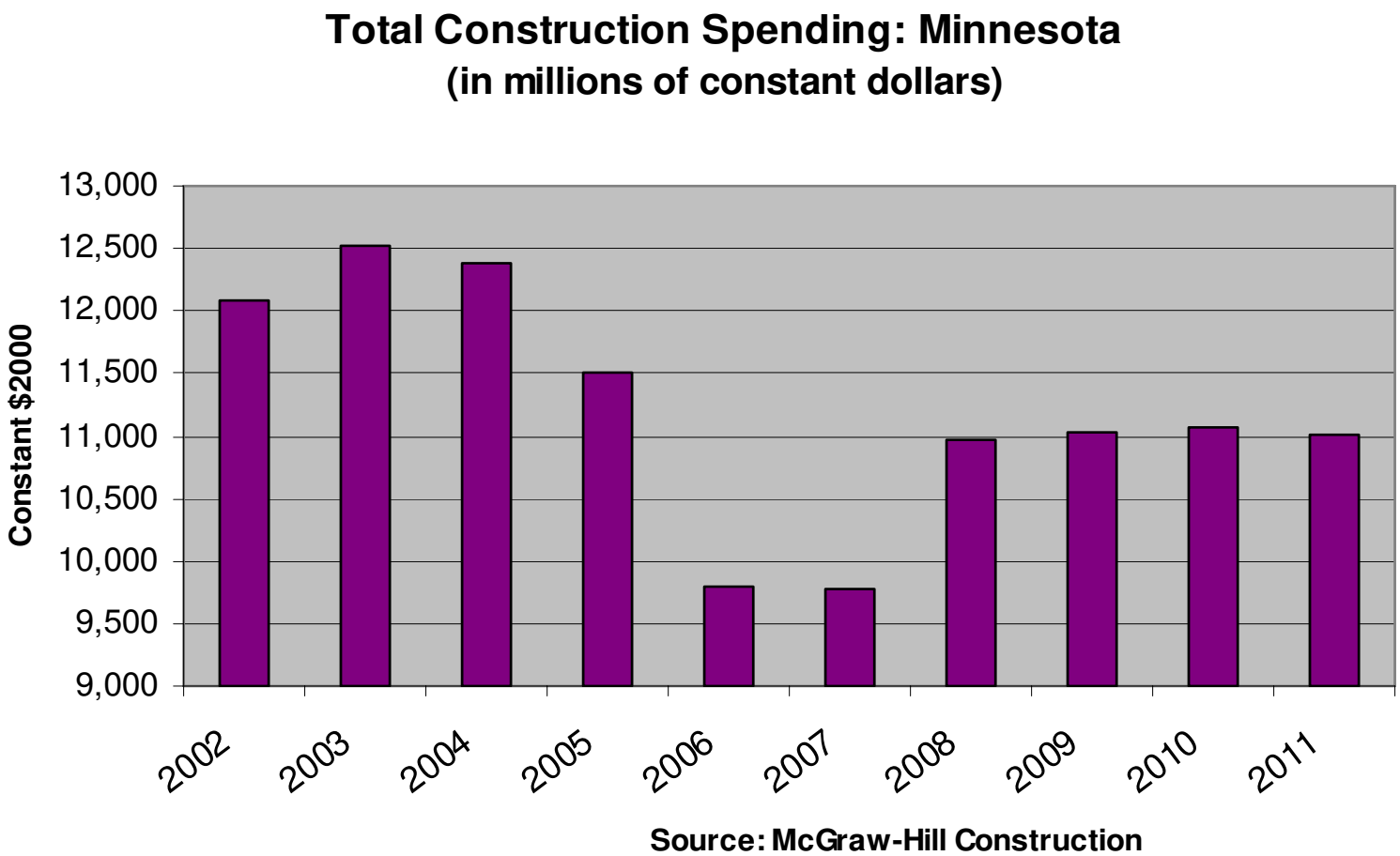
- The Midwestern states show slight gains in the demand for some building trades, but they tend to follow the patterns of building activity, particularly those building types that are heavy users of specific occupations
- The strongest gains at the regional level are for operating engineers, reinforcing iron and rebar workers, and insulation workers.
- Losses are predicted for structural iron and steel workers, plasterers and stucco masons, and roofers.
- Over time, demands for specific trades can vary substantially as building activity responds to changing populations and preferences

Projected Economic Growth is Modest

Selected Midwest States will Grow Slowly
Average Annual Growth in State Product

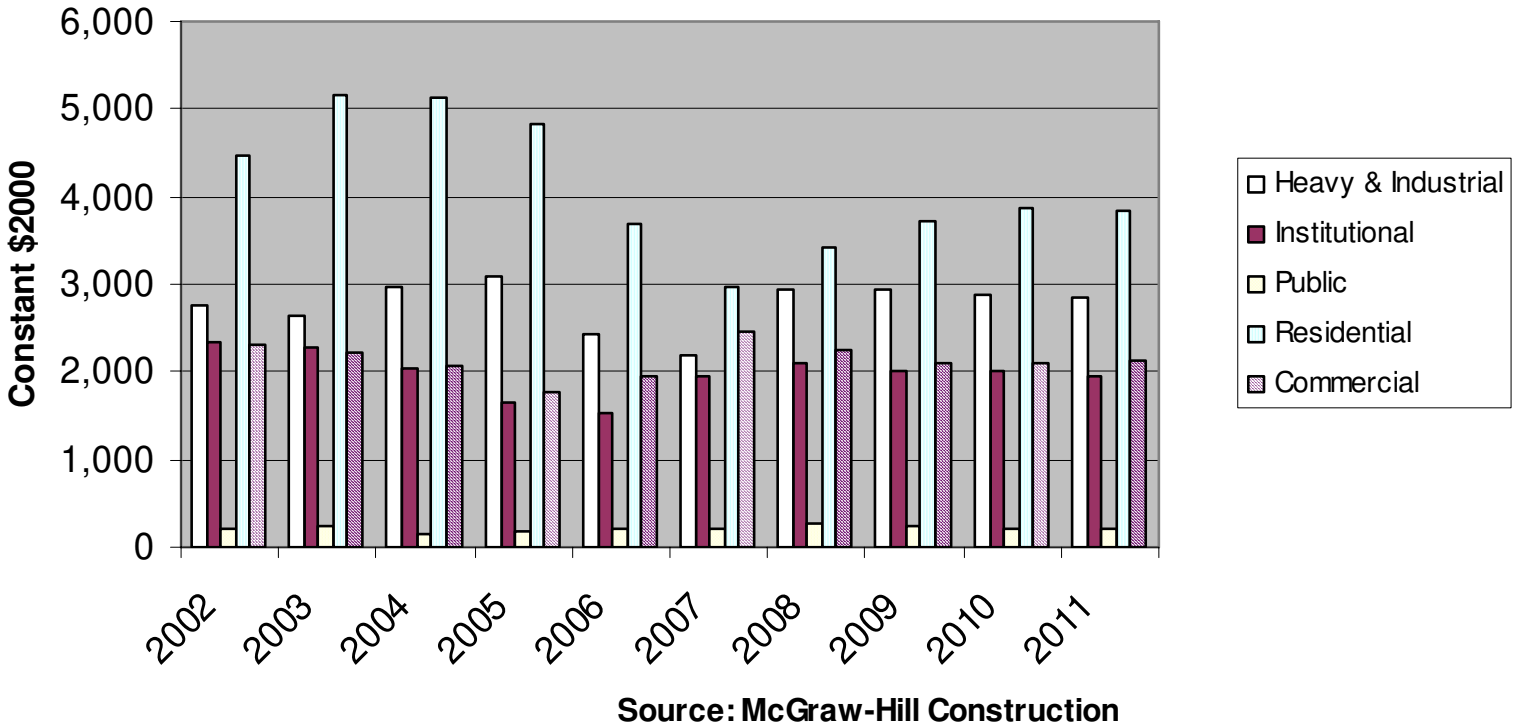
	2002-07	2007-11
Minnesota	***1.4%***	***1.9%***
Illinois	***3.4%***	***2.1%***
Indiana	***3.0%***	***2.1%***
Ohio	***1.2%***	***1.1%***
Michigan	***-1.8%***	***1.5%***
Wisconsin	***1.5%***	***1.8%***

What Does This Mean for a Particular State?



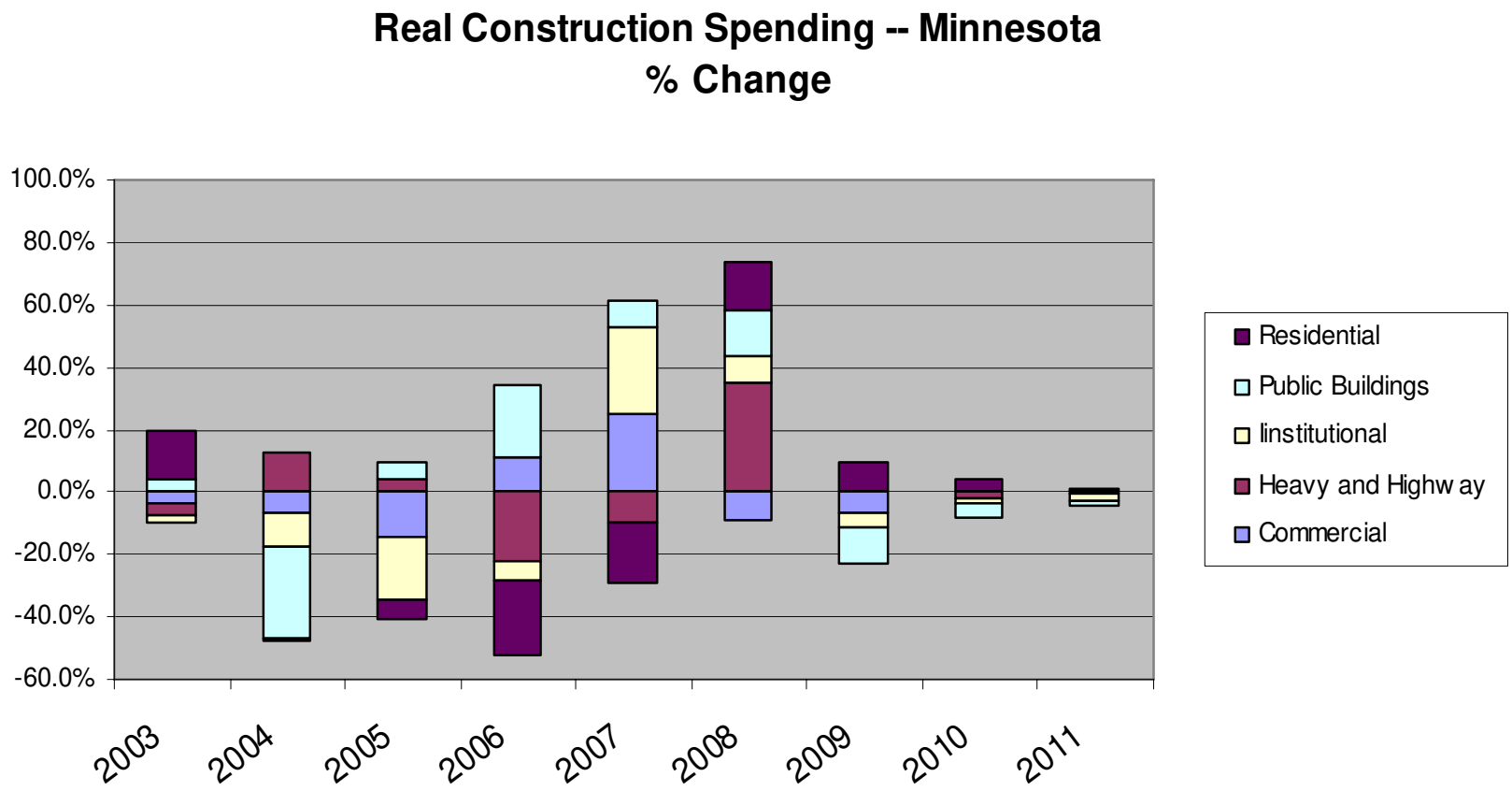
Variation by Building Type

Construction Spending by Project Type: Minnesota
(in millions of constant dollars)



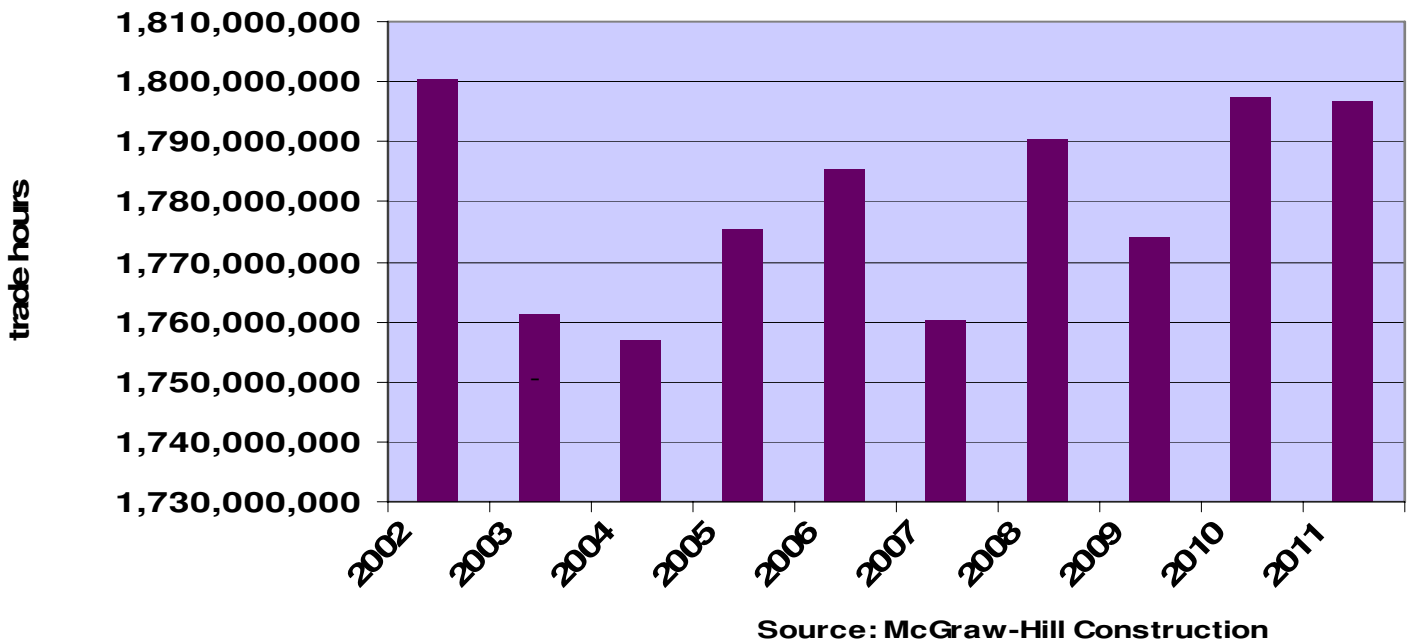
Source: McGraw-Hill Construction

Percentage Changes in Building Year-to-Year



Source: McGraw-Hil Construction

Total Skilled Trade Hours for the Midwest



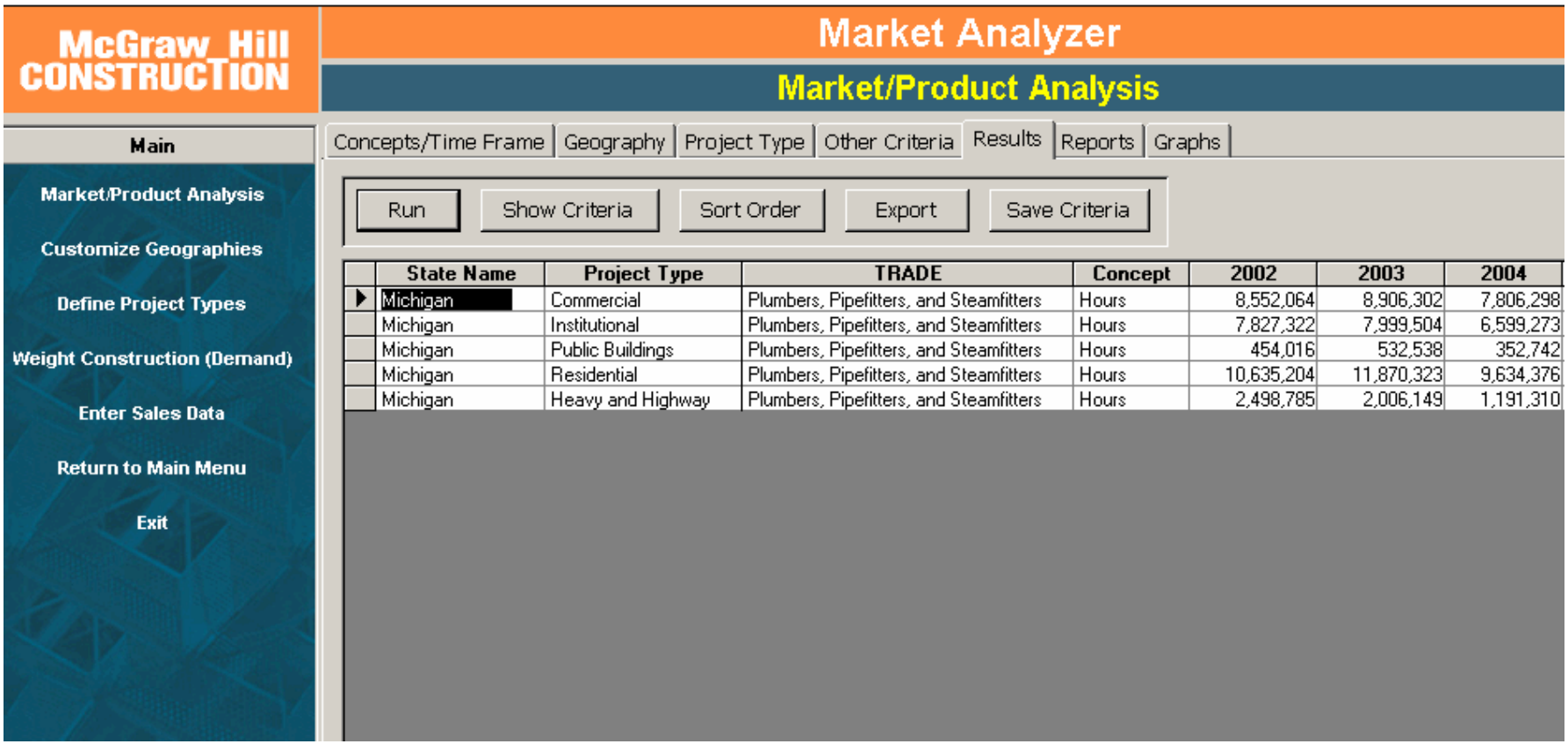
Total Trade Hours: Selected Trades

	2002-06	2007-11	%ch
Boilermakers	9,681,067	9,470,740	***-2.2%***
Brickmasons and Blockmasons	66,553,344	67,761,530	***1.8%***
Cement Masons and Concrete Finishers	93,646,259	99,088,673	***5.8%***
Carpenters	392,845,773	388,759,080	***-1.0%***
Construction Laborers	313,489,280	330,971,251	***5.6%***
Electricians	243,119,760	240,804,690	***-1.0%***
Glaziers	16,529,762	16,649,133	***0.7%***
Insulation Workers	22,741,726	24,366,579	***7.1%***
Painters, Construction and Maintenance	90,008,755	85,234,467	***-5.3%***

Building Trades Details

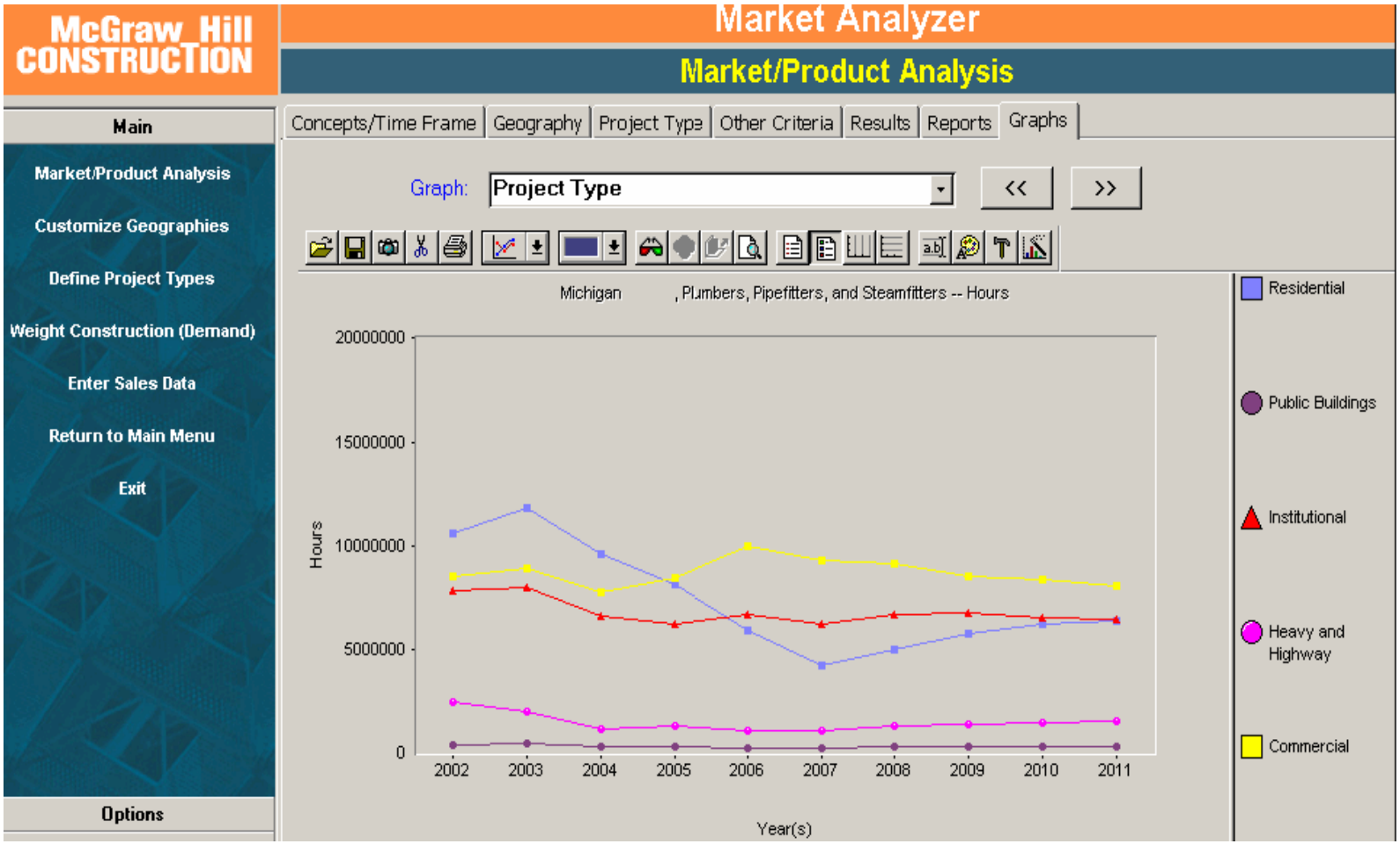
- There is a lot to be gained from viewing regional and state forecasts for the building trades
- Construction activity can shift substantially even when overall demands are stable
- Drilling down to smaller geographic areas is crucial to understanding what is really going on; it allows examination of local level forecasts that includes a review of large projects moving towards start
- This capability – drilling down to detailed geographical areas -- is provided in McGraw-Hill Construction's Market Analyzer Program

Market Analyzer Results



State Name	Project Type	TRADE	Concept	2002	2003	2004
Michigan	Commercial	Plumbers, Pipefitters, and Steamfitters	Hours	8,552,064	8,906,302	7,806,298
Michigan	Institutional	Plumbers, Pipefitters, and Steamfitters	Hours	7,827,322	7,999,504	6,599,273
Michigan	Public Buildings	Plumbers, Pipefitters, and Steamfitters	Hours	454,016	532,538	352,742
Michigan	Residential	Plumbers, Pipefitters, and Steamfitters	Hours	10,635,204	11,870,323	9,634,376
Michigan	Heavy and Highway	Plumbers, Pipefitters, and Steamfitters	Hours	2,498,785	2,006,149	1,191,310

Marker Analyzer Results



Final Thoughts

- The skilled trades demand methodology provides labor forecasts based on and consistent with McGraw-Hill Construction forecasts of building activity
- The results take account of local building practices and skilled trade shares
- The geographic and building detail in MHC forecasts means projections of demand for the skilled construction trades extend down to the county level
- Additional work is needed on ways to refine utilization rates, particularly for local and state geographies