

ACTIVITY SEQUENCE LOGICS USING DAILY WORK REPORT DATA



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Abstract

Accurate and reliable project duration estimation is highly dependent upon two major components;
 a) reasonable production rate estimation of major work items,
 b) logical sequencing of those work items.

The phase I of the study developed an MS Excel based production rate estimation tool (PRET). The phase II (this project) has developed construction activity sequence logic diagrams for most common work types in MDT.

Six most common highway project types in MDT are i) overlay (urban), ii) overlay (rural), iii) safety, iv) seal & cover, and v) bridge reconstruction and rehabilitation. These work types account for more than 60% of highway projects in MDT.

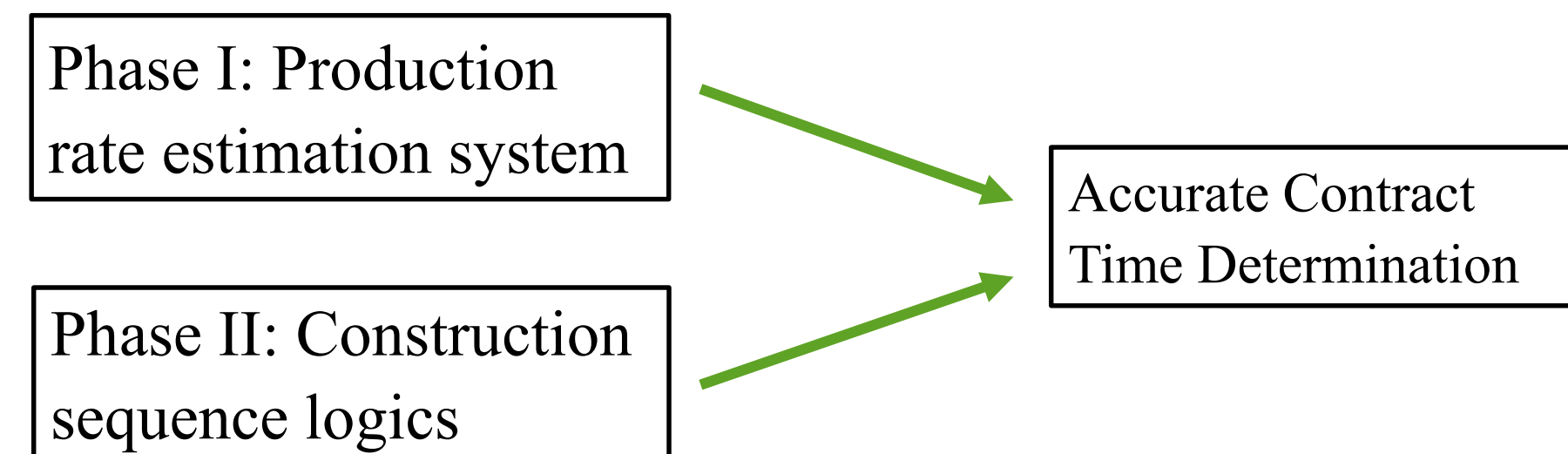
The current list of controlling work items has been expanded into 48 items.

For each work type, a construction activity sequence logic diagram was developed to illustrate frequent controlling work items and their sequential relationship.

The results of this research project can help MDT quickly identify the most common controlling work items and develop a reliable sequence logic for different types of highway projects.

Project Objectives

- The overall goal of the Phase II was to develop construction sequence logics for major project types using historical data available in Daily Work Report (DWR) data.
- The result of the Phase I and Phase II will enhance the MDT's current contract time determination procedure

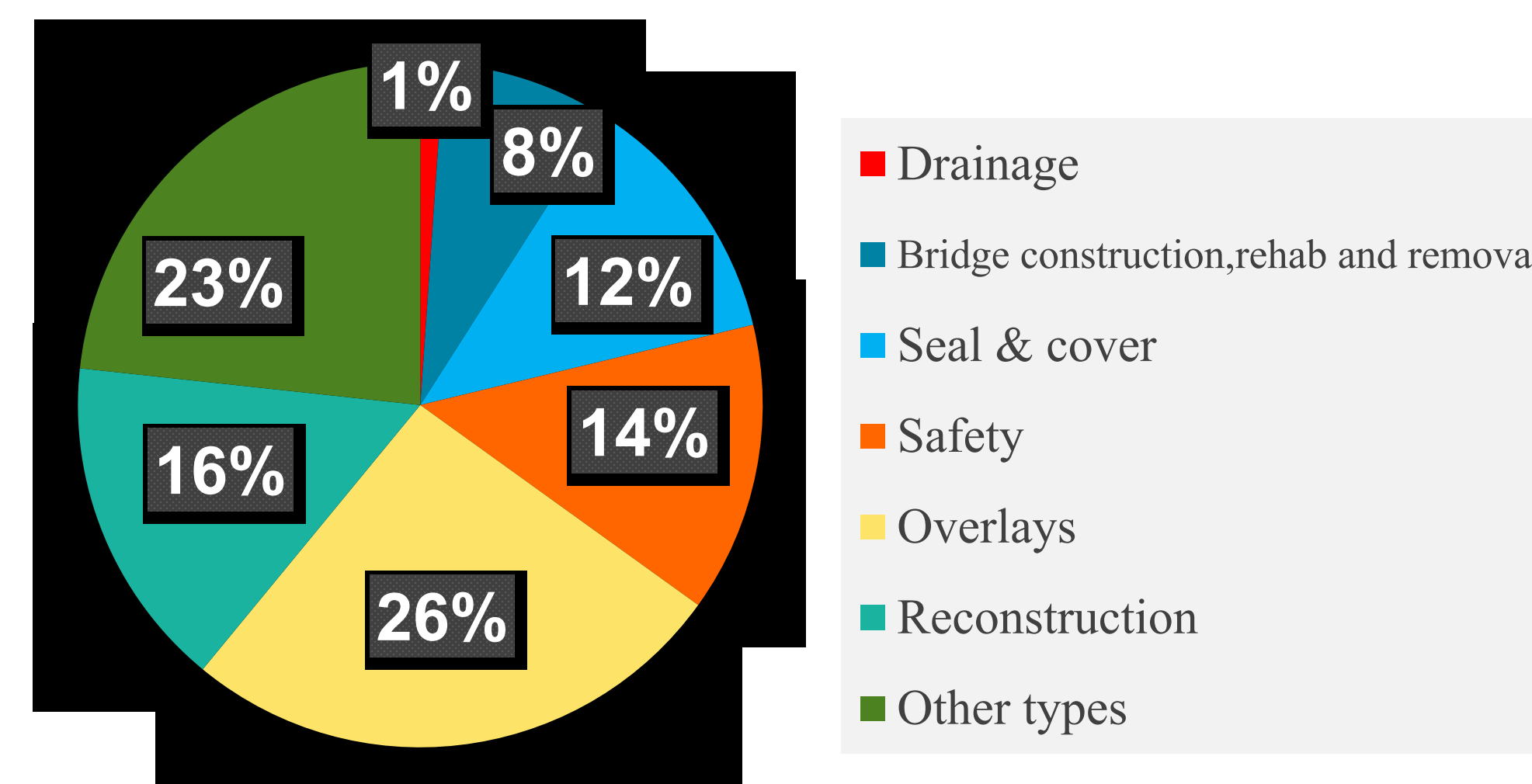


Historical Daily Work Report data

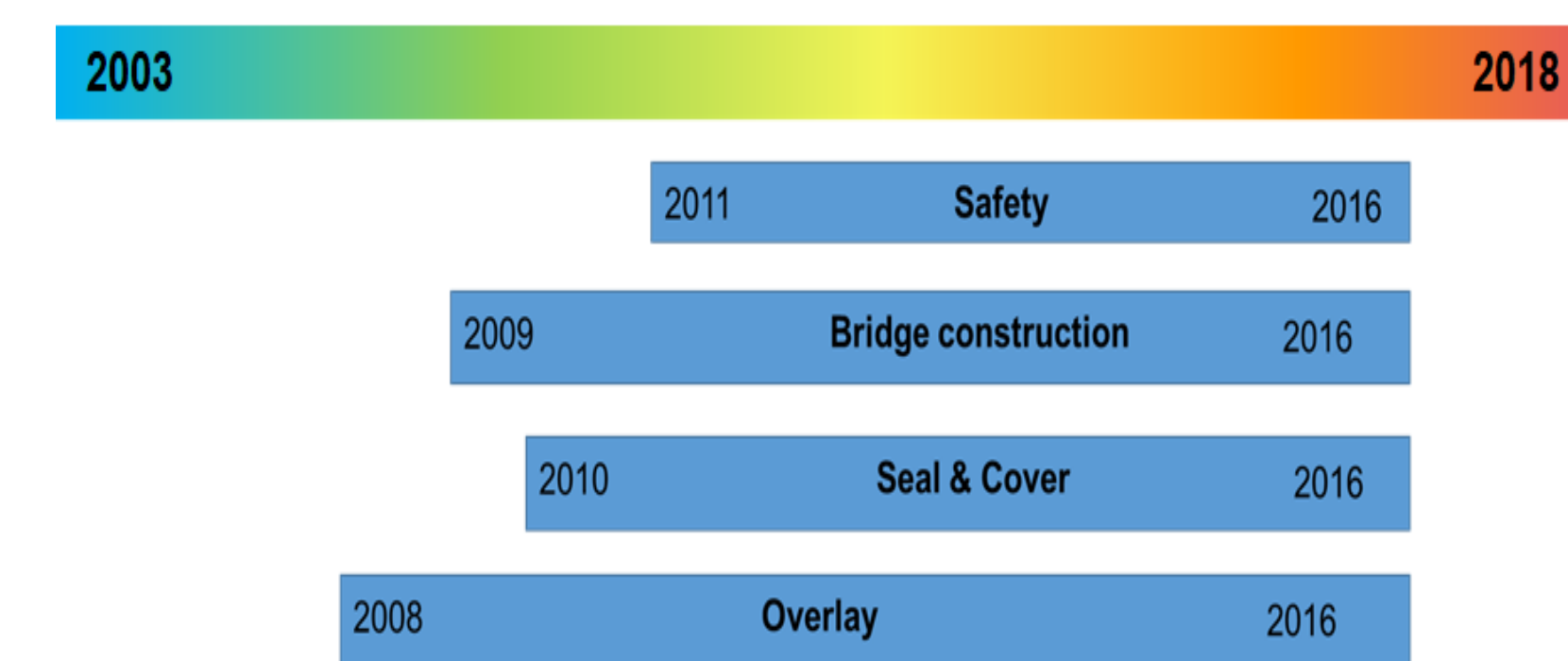
- The last 10 years of MDT DWR data were collected and analyzed.
- The DWR dataset includes 730 highway construction and maintenance projects.
- DWR data attributes: project number, type, location, contract amount, start and end date, pay item code, pay item description, and pay item implementation date.

Daily Work Report Data Description

Most common project types of MDT from 2003 to 2018.



DWR data range for major project types.



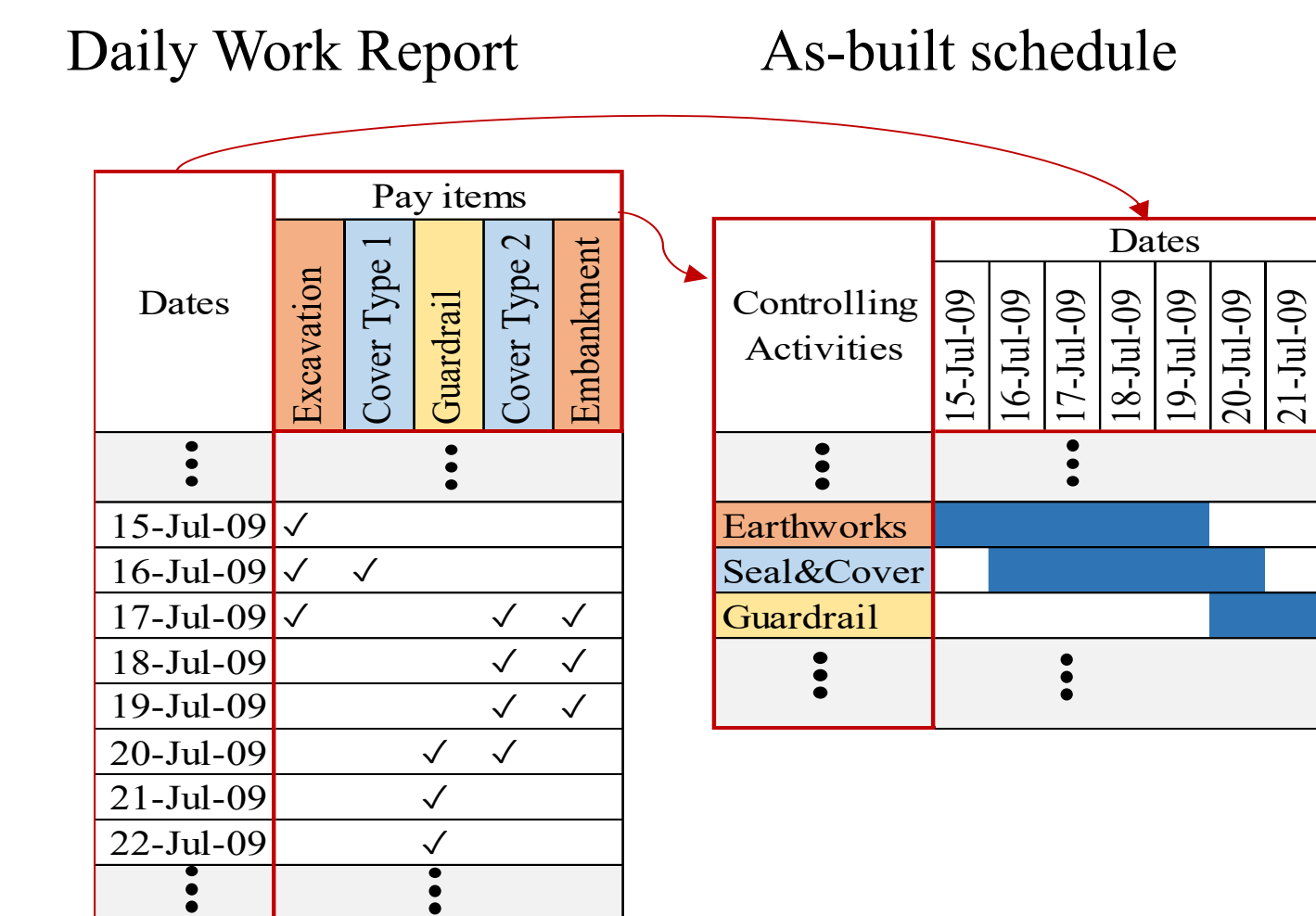
Controlling Work Items

Controlling work items are the work items that are likely to affect the duration of a project. The current list of controlling work items includes 31 items. From a comprehensive DWR data analysis, review of controlling work items in other DOTs and discussions with MDT scheduling experts, the current list has been expanded into 48 items. The expanded list now covers more than 90% of the activities in the DWR database.

Final list of extended controlling work items			
#	Item description	#	Item description
1	BASE-CEMENT TREATED	25	GEOTEXTILE
2	BEAMS	26	GUARD RAIL
3	BRIDGE APPROACH SLAB	27	MICROSURFACING
4	BRIDGE BACKFILL	28	MILLING AND PULVERIZING
5	BRIDGE DECK	29	MOBILIZATION
6	BRIDGE DECK MILLING	30	PAVEMENT MARKING
7	BRIDGE DECK REPAIR	31	PCCP
8	BRIDGE FOUNDATION	32	PLANT MIX SURFACING
9	BRIDGE PAINTING	33	REIN CONC BOX
10	CLEARING AND GRUBBING	34	REINFORCING STEEL
11	CONCRETE BARRIER RAIL	35	REMOVE EXISTING STRUCTURES
12	CONCRETE BARRIER RAIL-BRIDGE	36	RETAINING WALL
13	CONCRETE-CLASS OVERLAY	37	REVISE BRIDGE CONCRETE BARRIER
14	SEAL & COVER	38	RIPRAP
15	CRACK SEALING	39	RUMBLE STRIPS
16	CRUSHED AGGREGATE COURSE	40	SEEDING
17	CURB AND GUTTER	41	SHOULDER GRAVEL
18	DECK GROOVING (after curing)	42	SIDEWALK
19	DETOURING	43	SIGNS
20	DRAINAGE PIPE (<= 24 IN)	44	SPECIAL BORROW
21	DRAINAGE PIPE (> 24 IN)	45	SSPP
22	EARTH WORKS	46	TOPSOIL-SALVAGING AND PLACING
23	FARM FENCE	47	WING WALLS
24	GEOGRID	48	FINAL SWEEP AND BROOM

As-built Schedule Development

An as-built schedule for each project was developed using project pay items, their implementation dates in DWR data and the controlling activity list. Note: some pay items from DWR were aggregated to a controlling work item using the extended list and their implementation dates were added together to compute the duration of each controlling work item.



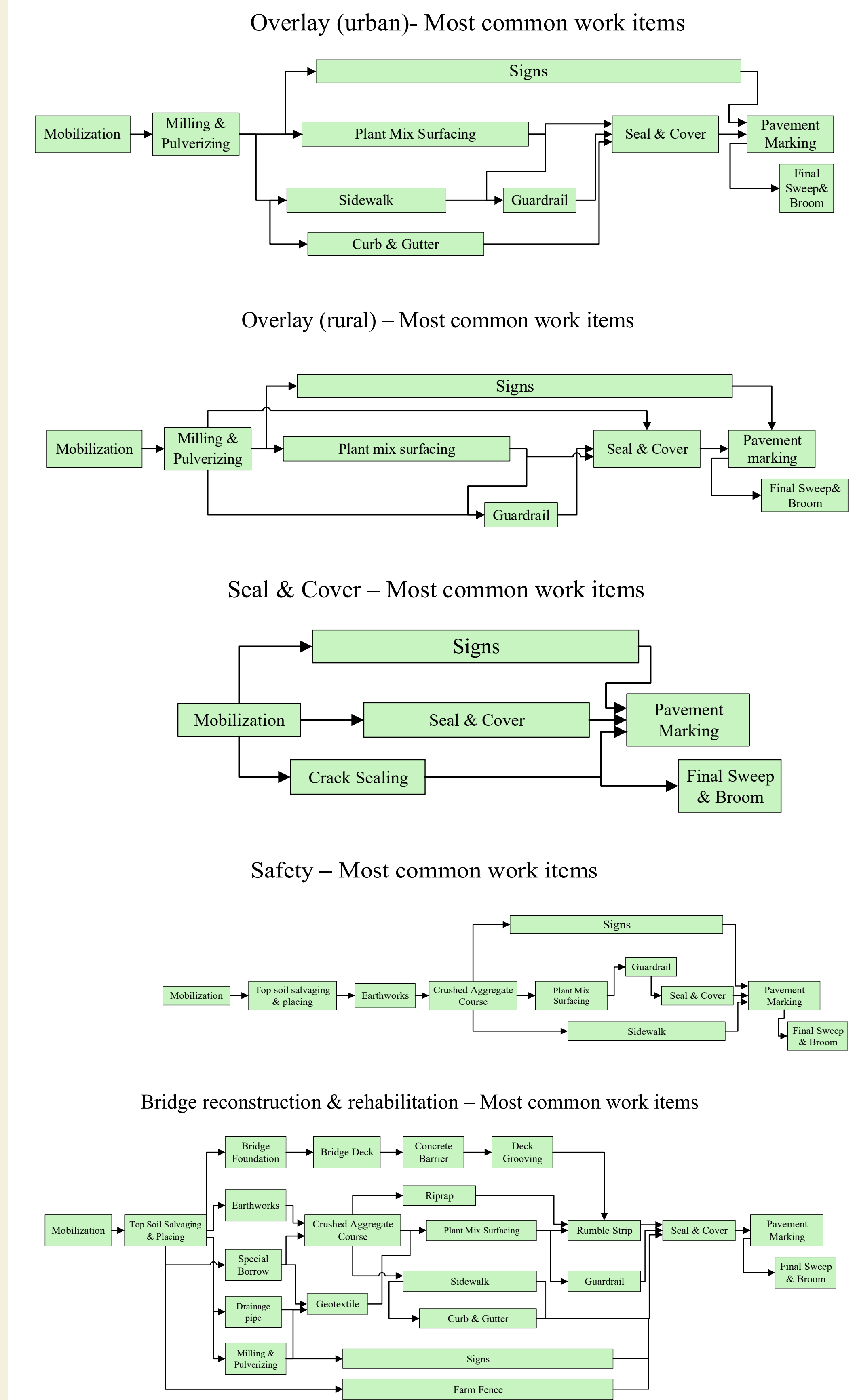
Common Work Items for Each Project Type

The most common activities in each project type were identified using a frequency analysis of work items and opinions from MDT schedulers. The table below shows the frequency analysis result of DWR data and MDT schedulers' opinions for overlay projects, including urban and rural. The same type of table for other project types is available in the final report.

Overlay				
Controlling Work Items	Frequency	Percentage	Expert's Opinion (Urban)	Expert's Opinion (Rural)
MOBILIZATION	190	99%	Common	Common
PAVEMENT MARKING	187	98%	Common	Common
MILLING AND PULVERIZING	181	95%	Common	Common
SEAL AND COVER	171	90%	Common	Common
REMOVE EXISTING STRUCTURES	166	87%	Not Applicable	Not Applicable
PLANT MIX SURFACING	156	82%	Common	Common
SIGNS	135	71%	Common	Common
GUARD RAIL	99	52%	Common	Common
RUMBLE STRIPS	83	43%	Not Common	Not Applicable
CRUSHED AGGREGATE COURSE	58	30%	Not Common	Not Applicable
FINAL SWEEP AND BROOM	57	30%	Common	Common
SIDEWALK	36	19%	Common	Not Applicable
CURB AND GUTTER	32	17%	Common	Not Applicable
GEOTEXTILE	30	16%	Not Common	Not Applicable
SPECIAL BORROW	30	16%	Not Common	Not Common
EARTH WORKS	29	15%	Not Common	Not Common
TOPSOIL-SALVAGING AND PLACING	12	6%	Not Applicable	Not Common
FARM FENCE	11	6%	Not Applicable	Not Applicable
Total	191			

Construction Activity Sequence Logics

As-built schedules of representative projects for each project type were integrated with MDT schedulers' knowledge and experience to develop a common sequence logic diagram for each project type. The diagrams were developed in two forms: 1) including only common work items and 2) including both common and not common work items. The diagrams below indicate the sequence logics for common work items. Other diagrams and with a detail description are available in the report.



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