

Construction activity sequence logics for major project types

In this document, the final sequence logics for MDT highway projects are described. To identify final sequence logics, five steps were successfully passed; I) obtaining MDT Daily Work Report (DWR) data that includes the data of 730 highway projects, II) analyzing the DWR data to identify five most common project types and common controlling work items, III) developing an initial draft of activity sequence logics using as-built schedules obtained from data for five most common projects, IV) discussion on the outputs obtained from data analysis with MDT schedulers and receive their opinions, V) asking MDT schedulers to draw an activity sequence logic for selected sample projects of each project type, and VI) combining the activity sequence logic from DWR data analysis with MDT schedulers' drawings to develop final sequence logics. The final list of most common projects and the list of sequence logics is provided in following:

Most common highway projects in MDT

This table shows the five most common project types in MDT and the total number of projects in each type. It shows that the five most common project types cover 60% of the highway projects in MDT.

List of the most common project types		Total number of projects of the type	Percentage of the total number of projects of the type
1	Overlay (urban)	40	5.5%
2	Overlay (rural)	150	20.5%
3	Seal & cover	89	12.0%
4	Bridge construction, rehabilitation and removal	58	8.0%
5	Safety	100	14.0%
<i>Total</i>		<i>437</i>	<i>60.0%</i>

Final activity sequence logics for common highway projects in MDT

1. Overlay (urban)

Figure 1 shows the final activity sequence logic diagrams for urban overlay projects including two diagrams; A) sequence logic for all possible activities and B) sequence logic for common activities that occur most of the time. According to the identified sequence logic for all possible activities (Figure 1- A), urban overlay projects typically start off with mobilization followed by milling & pulverizing. Earthworks include the controlling work items of: “excavation-street”, “excavation-unclassified”, “excavation-muck”, and “embankment in place”. The special borrow is performed in parallel to earthworks. After that, crushed aggregate course in parallel with geotextile is performed. Plant mix surfacing is performed right after the crushed aggregate course and two activities of sidewalk and curb & gutter are implemented at the same time. Rumble strip is

implemented after the plant mix surfacing and if the project includes a guardrail implementation, it is constructed at the same time. Seal & cover is before pavement marking and is performed after almost all activities are completed. Signs instalments can be performed from early stages of the project in parallel with other controlling work items until the pavement marking. Final sweep and broom is started after the start of pavement marking with a lag time, which is typically the last work item. Figure 1 - B shows the sequence logic of the common work items, where the rare items are eliminated.

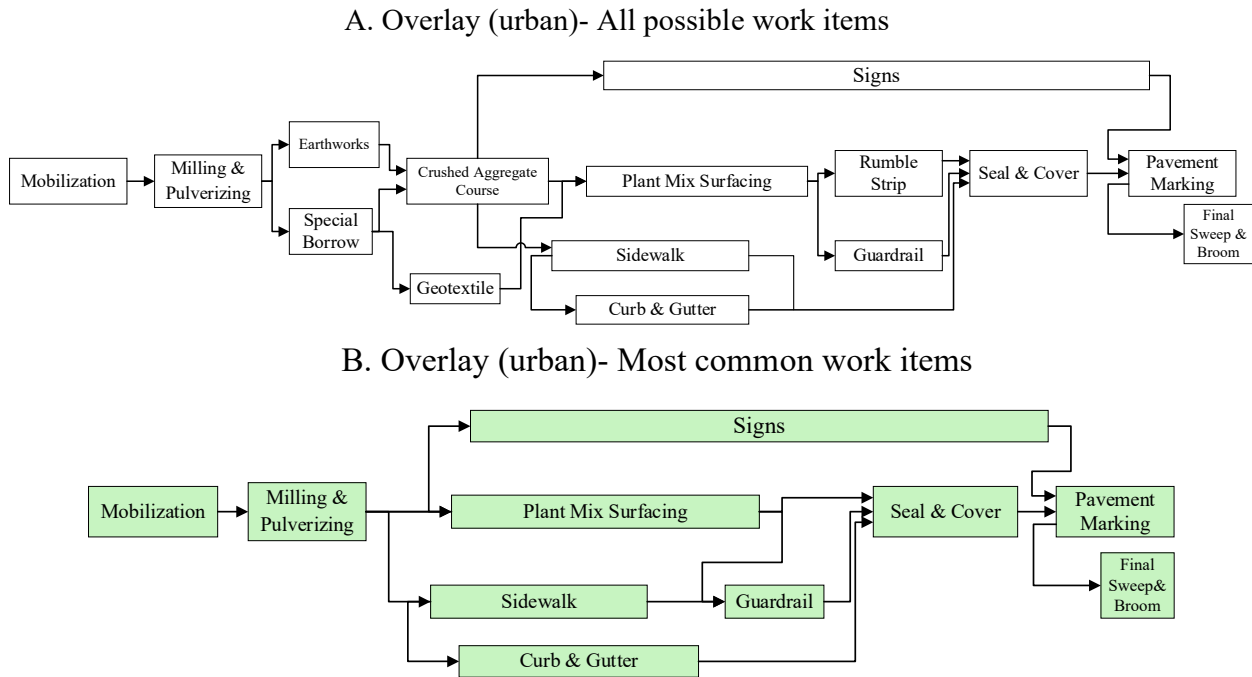
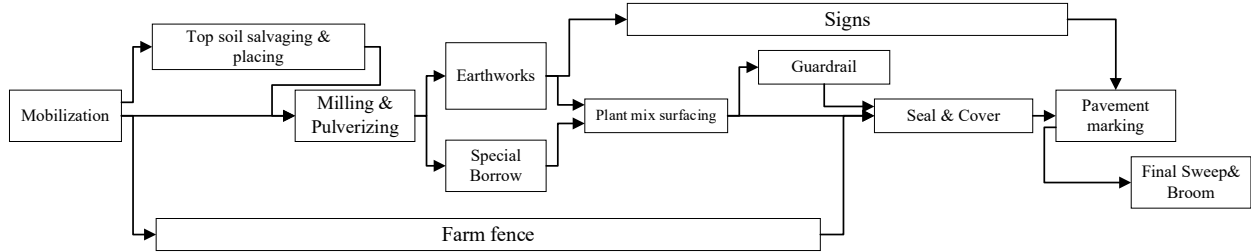


Figure 1 The sequence logic diagram for overlay projects in urban areas

2. Overlay (rural)

Figure 2 shows the activity sequence logic for overlay projects implementing in rural areas in two parts; A) sequence logic for all possible activities and B) sequence logic for common activities that occur most of the time. Comparing with overlay projects in urban areas, some controlling work items are more common in rural areas such as topsoil salvaging & placing, guardrail, and farm fence, while some others are more typical for urban areas such as rumble strip, and sidewalk. In rural areas, the work item of topsoil salvaging is performed after mobilization and have an overlapping with milling and pulverizing. Farm fence is implemented throughout the project simultaneous with other activities. Other controlling work items implementation are similar to overlay projects in urban areas. Figure 2 – B indicates the sequence logic of most common activities, where the rare activities are eliminated.

A. Overlay (rural) – All possible work items



B. Overlay (rural) – Most common work items

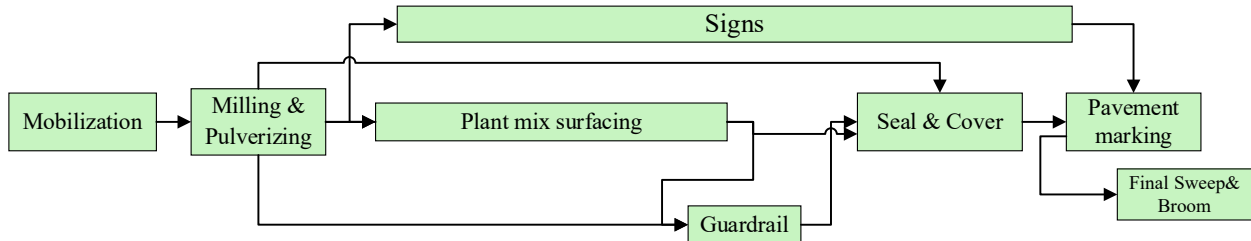
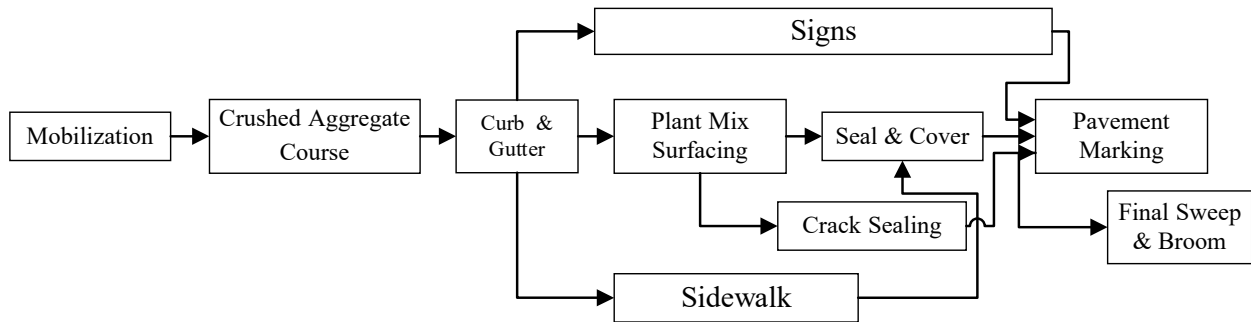


Figure 2 The sequence logic diagram for overlay projects in rural areas

3. Seal & Cover

Figure 3 represents the activity sequence logic for seal & cover projects in two parts; A) sequence logic for all possible activities and B) sequence logic for common activities that occur most of the time. According to Figure 3 – A, seal & cover projects start off with mobilization followed by crushed aggregate course, curb & gutter, plant mix surfacing, seal & cover, pavement marking, and final sweep & broom. This chain of activities is typically the critical path of seal & cover projects. The activity of crack sealing is started before starting of the seal & cover activity but finishes sooner. Sidewalk and signs are implemented along the project concurrent with plant mix surfacing and seal & cover. The project finishes with the final sweep & broom. Figure 3 – B indicates the sequence logic of seal & cover projects that just includes the most common activities.

A. Seal & Cover – All possible work items



B. Seal & Cover – Most common work items

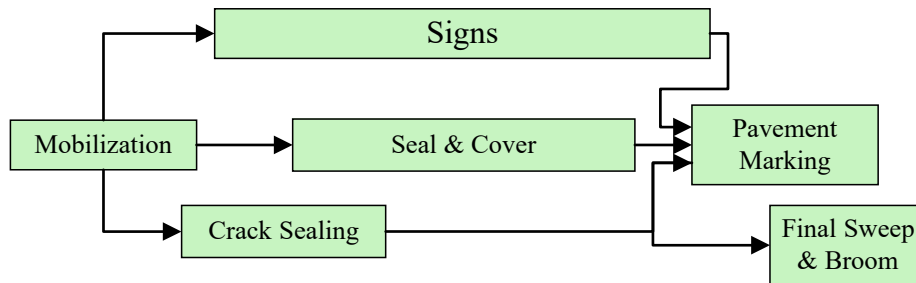
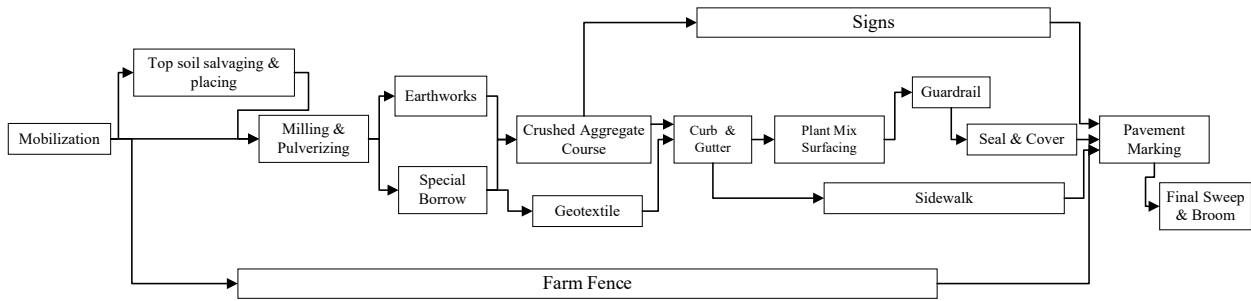


Figure 3 The sequence logic diagram for seal & cover projects

4. Safety

Figure 4 represents the activity sequence logic for safety projects in two parts; A) sequence logic for all possible activities and B) sequence logic for common activities that occur most of the time. Work items and the sequential implementation in safety projects are similar to overlay projects.

A. Safety – All possible work items



B. Safety – Most common work items

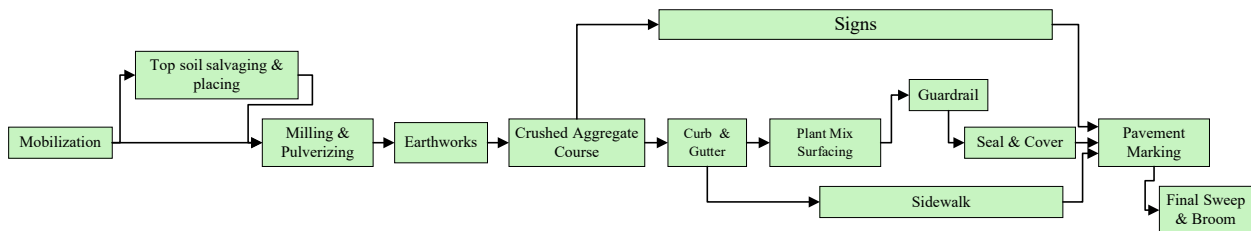


Figure 4 The sequence logic diagram for safety projects

5. Bridge reconstruction and rehabilitation

Figure 5 represents the activity sequence logic for bridge reconstruction and rehabilitation. The sequential implementation of work items is similar to the previous project types and follow the same sequential order. However, it includes some additional activities. Drainage pipe is performed in parallel with earthworks, special borrow, and bridge foundation. The work item of reinforced concrete deck is implemented at almost the same time. A chain of bridge works is performed in parallel with other activities, including bridge foundation, bridge deck, concrete barrier, and deck grooving. Riprap is performed at the same time with plant mix surfacing and sidewalk. The project finishes with implanting pavement marking and final sweep & broom.

Bridge reconstruction & rehabilitation – Most common work items

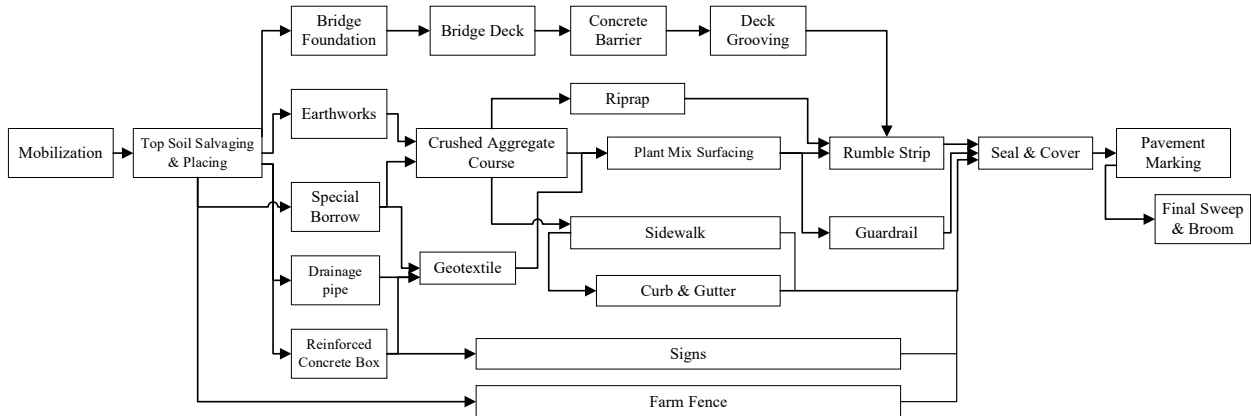


Figure 5 The sequence logic diagram for bridge reconstruction and rehabilitation projects