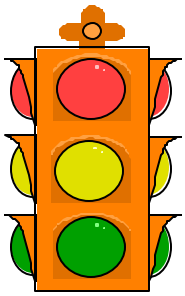
UTAH TRAFFIC LAB
UNIVERSITY OF UTAH

Signal Timings for Inclement Weather



Fixed-time traffic signal timing plans provide coordination, which reduces delays, stops, and emissions. Plans are developed using measured speed, volume, saturation flow, and lost time. These parameters are most often measured during dry weather conditions. Any deviation from dry conditions changes the fundamental parameters, rendering plans sub-optimal. For example, snow and ice on the road reduces speed, saturation flow, acceleration and deceleration rates, and increases lost time.

Researchers at the Utah Traffic Lab (UTL) developed a method to create a fixed-time plan for inclement weather conditions based on the fixed-time plans used in dry conditions. To develop the method, UTL investigated the following two objectives:

1. How speed, saturation flow, and start-up lost time change during inclement weather.
2. What the Utah Department of Transportation (UDOT) should consider before activating an inclement weather signal timing plan for areas in the Salt Lake Valley.

The UDOT Advanced Traffic Management System allows an operator to change signal timing plans from a central location. With this ability, UDOT is developing a library of fixed-time plans around the valley, including plans for specific events, incidents, and inclement weather.

UTL met the first objective by measuring saturation flow, speed, and start-up lost time during varying weather conditions. It found that the decrease in the average speed is greatest just as slush begins to stick to the road. Figure 1 illustrates how speed changes over various levels of inclement weather severity, relative to dry weather speed.

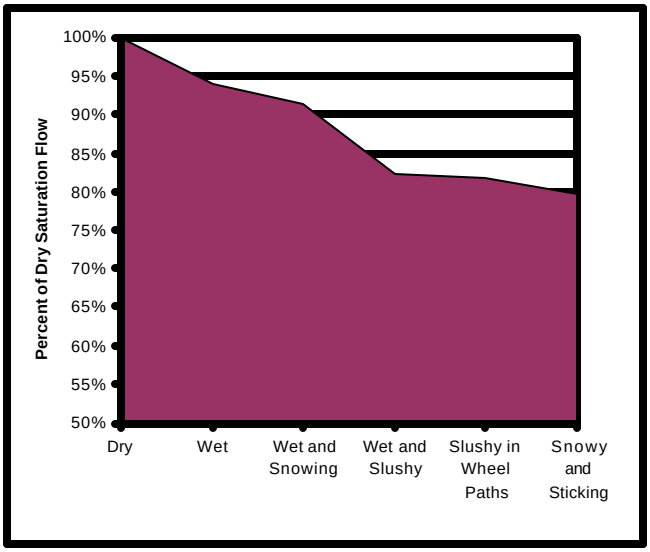


Figure 1: Dry Speed Percentage in inclement weather conditions

Figure 2 shows that saturation flows also change most when slush begins to accumulate on the road.

A fixed-time signal plan generally consists of the cycle time, the split, and the offset. UTL recommends that only the offset

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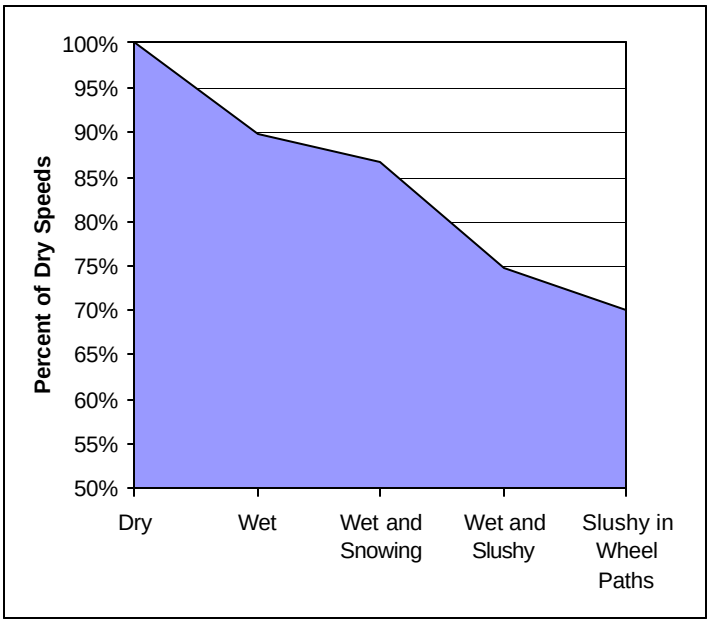

Figure 2: Dry Speed percentage in inclement weather

Table 1: Change in Traffic Flow Parameters

Flow Parameter	Percent change from Dry Condition
Speed	70%
Saturation Flow	80%
Lost Time	123%

should be changed. The increase in start-up lost time suggests that the amber time and all-red time be increased by 1 second each. All-red time should be increased in order to allow vehicles sufficient time to complete a left-turn. Amber time should be extended in order to accommodate lower deceleration rates.

An inclement weather signal timing plan can be developed by modifying speed, saturation flow, and start-up lost time according to the values in Table 1. Using these values, the fixed-time plan development software will generate a plan appropriate for inclement weather. There is also a four-step guideline that UDOT should consider before triggering an inclement weather plan:

UTL Recommended Guidelines

1. The storm must cause adverse road surface conditions ranging from slushy wheel paths to snow packed.
2. The storm duration must be 20 minutes or more.
3. The storm must affect enough signalized corridor to be effective.
4. The traffic must be sufficiently congested to warrant a signal plan change.

Project Contacts

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For more details, see our website.

www.trafficlab.utah.edu

There you will also find project reports, facilities and graduate student opportunities.

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