Modular Building Block Approach to Construction Assembly in Place Mini-Roundabouts

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Description:

Mini-roundabout is a single-lane roundabout with a traversable central island and splitter islands. The inscribed circular diameter of mini-roundabout ranges from 50 ft to 90 ft. This intersection design is suitable for junctions of 2-lane and/or 3-lane high volume collector roads. A well designed mini-roundabout can deliver more than twice the traffic handling capacity when compared to intersections under All-Way-Stop-Control. Limited deployments in the United States show the following types of traffic operation and safety problems can be effectively addressed by mini-roundabout design:

1. Eliminate traffic congestion at All-Way-Stop-Controlled intersections,
2. Reduce major road approaching speed at Two-Way-Stop-Controlled intersections to provide more gaps to minor road traffic.
3. Provide a viable intersection improvement option when a regular sized roundabout is too costly due to costs of purchasing additional land and relocating utility lines and storm drainage system.
4. Calm the traffic and improve safety for both vehicle drivers and pedestrians and bicyclists.

Mini-roundabout is one of the alternative intersection designs being promoted nation-wide by the USDOT under the second round of Every Day Count (EDC2) initiative. The superior traffic handling capability of this intersection design has been proven at multiple sites that used to suffer recurring congestion and speed or congestion induced traffic safety problems. However, the costs of mini-roundabouts vary significantly by location. At some locations, mini-roundabouts were installed in one or 2 days at costs of $20,000 or less each; at other locations, it took 3 weeks and over $300,000 to construct a mini-roundabout. Such range of cost variation hinders the wider adoption of mini-roundabout design.

The objective of this project is to develop modular curbing and delineation designs that can be configured to form into sidewalk curbs, central islands, and splitter islands of different sizes (like the building blocks used in landscape projects). These modular blocks must be strong enough to withstand up to 22,000 lb/axle occasional truck load; and durable enough to last 10 years without change in shape or reduction in strength. Ideally, the modular blocks can be manufactured using recyclable material that would otherwise end up into the landfill; the mass production of such “building block” material shall reduce the cost of mini-roundabout installation and make the cost of mini-roundabout construction highly predictable.

Expected Phase I Outcomes:

The desired Phase I outcomes are:

1. Prove that the modular building block concept for mini-roundabout construction is feasible and has significant cost advantage over the cast in place construction method.
2. Design and prototype modular blocks that can:
    1. Form into central islands of 3 different diameters commonly used in mini-roundabout design
    2. Form into corner curbs of 3 different diameters commonly used in urban street curb design
    3. Form into splitter islands and bulb-outs (chicanes) commonly used in traffic calming applications
3. Develop attachment hardware that can anchor the modular blocks onto the roadway surface
4. Develop draining mechanism that facilitates water to drain towards the designated areas.
5. Produce complete designs of 3 typical sized mini-roundabouts using assembly in place modular blocks (drawing, shapes of modular blocks needed, number of each type of modular blocks, the completed set of hardware, and the estimated cost).

Expected Phase II Outcomes:

Assuming the Phase I products are satisfactory, the desired outcome of Phase II is to produce enough modular blocks to prove the concept at five to six intersections to explore the level of labor effort and the types of tools needed to construct different sized assembly in place mini-roundabouts, the amount of modular block material needed, and the total costs of such projects.