Delaware Department of Transportation
Design Guidance Memorandum

Memorandum Number: 1-24

1. Road Design
2. Bridge Design
3. Utilities Design
4. Right of Way
5. Other

Title: Road User Cost (RUC) Analysis Effective Date: 07/10/2026

I. Purpose

To provide guidance and standardize the process for calculating the hourly or daily Road User Cost (RUC) for road construction projects to determine the work zone impacts to the traveling public resulting from anticipated lane closures or detours.

II. Requirements

RUCs should be considered for all projects that include lane closure hours that were determined by analysis of hourly or daily traffic volumes as determined by the Transportation Management Plan (TMP) or Traffic Safety using analyzed data and traffic volumes. RUCs should be considered for all projects that have scheduled roadway or ramp closures and detours. Traffic Safety or the results of a TMP may determine the need for RUCs in other situations. The Design Project manager is the responsible approving party, with input from Construction and Traffic Safety.

RUCs provide the administering construction section with tools to enforce the provisions of the contract to provide for minimal impact to the traveling public. Daily or hourly RUC can be applied to projects with allowable lane or road closure hours for the late opening of travel lanes or roadways to unrestricted use by the traveling public. Daily RUC values can be used as guidance when determining contractor incentive/disincentive (if appropriate), or the "B" value for contracts using A+B bidding.

III. Responsibilities

For projects that are designed without a DelDOT design consultant the calculation of RUCs is the responsibility of the Division of Transportation Solutions (DOTS) Traffic Safety Section. For projects with DelDOT design consultants, calculation of RUCs is the responsibility of the DelDOT design consultant. The Traffic Safety Section will review RUC calculations provided by the DelDOT design consultant. RUC calculations are documented in a project's TMP or is provided as a separate technical document for those projects not requiring a written TMP. Reference the Work Zone Safety & Mobility Procedures and Guidelines for guidance regarding TMPs[1].

[1] https://deldot.gov/Publications/manuals/de_mutcd

Upon completion of RUC calculations, the Traffic Safety Section or DelDOT design consultant, will provide calculated RUCs to the design project manager for use in preparing the Contract. The design project manager will coordinate with Engineering Support to develop the final contract language and incorporate the RUC Special Provision into the Contract.

IV. Design Guidance

The calculations for RUC analysis are based on the methodologies presented in the American Association of State Highway and Transportation Officials (AASHTO) publication User and Non-User Benefit Analysis for Highways (September 2010) commonly referred to as the Red Book. The methodology involves calculating two primary components of user cost – delay costs and operating costs – along the affected route(s). The calculations utilize standard values of time and operating costs, which adjust annually based on inflation. The annual values of time and operating costs are provided as an attachment to this memo and can be found within DelDOT's Design Resource Center[2]. All available data should be utilized to determine hourly, daily, monthly, and annual traffic volumes to best represent the conditions during the specific lane or road closure. Heavy vehicle percentages should be obtained to include in the operating costs. RUCs should be applied to projects including, but not limited to:

[2] https://deldot.gov/Business/drc

- a detour (full closure or closure during allowable closure hours),
- a multi-lane roadway when one or more travel lanes are closed,
- flagging operations on roadways with an ADT of 12,000 or greater,
- project locations that have a justified work zone limitation such as: working hours within a municipality, or
- projects recommended by the Traffic Safety Section.

RUCs should be applied to projects where there are interim milestones, where A+B bidding or other contracting mechanisms are used. RUCs should be used as a guide to determine the "B" portion of the A+B Bidding component. RUCs may also be used to determine the amount of a contractor incentive or disincentive that can be applied to specific project milestones, overall project completion, or other elements to improve project delivery.

A. Calculated Delay Costs

When a motorist is delayed traveling through or around a work zone, there is a value of time associated with the time lost. These delays are associated with lane closures that occur within the project limits or due to the additional delay incurred by traveling a detour route. Delay costs are calculated for all projects that have lane closures or road closures/detours. The Red Book defines a road user's value of time using the following equations:

$$\textit{Value of time per car} = \textit{Average vehicle occupancy} \times 50\% \times \textit{Average wage rate}$$

$$\textit{Value of time per truck} = \textit{Average vehicle occupancy} \times 100\% \times \textit{Average truck driver compensation}$$

Annually, the Traffic Safety Section, in consultation with Contract Administration, will determine the appropriate values of time that are used for RUC calculation purposes based on the Consumer Price Index. In the yearly attachments found under the Road User Cost Analysis Design Guidance Memorandum[3], see Table Attachment for current values of time.

[3] https://deldot.gov/Publications/manuals/dgm

The additional delay resulting from lane closures or detours is calculated for every project that requires a lane closure or detour. Delay can be calculated using travel time runs, simulation model runs, segment analysis, Bluetooth data, or software packages such as, but not limited to, *Synchro* and *SimTraffic.* Delay should be calculated in hours per vehicle to be consistent with the units used for the value of time. If necessary, contact the Traffic Safety Section for assistance with the delay calculations.

Once the value of time and delay are known, the daily (or hourly) delay cost associated with the work zone can be calculated using the following equation:

$$Daily\ Delay\ Cost = Avg\ Delay \times (ADT \times \%autos \times VOT_a + ADT \times \%light \times VOT_l + ADT \times \%heavy \times VOT_h)$$

Where:
Avg delay = average delay per vehicle (hr/veh)
ADT = average daily traffic
% auto = percentage of non-trucks in the traffic stream
VOT_a = value of time per auto ($/hr) from Table 1 Attachment
% light = percentage of light trucks in the traffic stream
VOT_l = value of time per light truck ($/hr) from Table 1 Attachment
% heavy = percentage of heavy trucks in the traffic stream
VOT_h = value of time per heavy truck ($/hr) from Table 1 Attachment

The percentages of trucks (light and heavy) can be estimated from available turning movement counts, from vehicle classification data from existing 24/7 traffic monitoring sites or by using the percentages for the appropriate Traffic Pattern Group as identified in DelDOT's annual Vehicle Volume Summary[4]. Data from existing 24/7 traffic monitoring sites can be obtained by contacting the with access to the TMC Extranet or by contracting the DelDOT Transportation Management Center (TMC). For the purposes of RUC calculations, a light truck is defined as a single unit truck with 3 or more axles, larger than a pick-up truck (includes buses). Heavy trucks are considered to be all tractor-trailer type vehicles. In the absence of data on light trucks, that value can be omitted from the calculation.

[4] https://deldot.gov/Publications/manuals/traffic_counts

Hourly delay costs for a project are typically calculated on a daily basis using the procedure already described. However, in some cases, hourly delay cost values will be required. In these cases (such as for an overnight lane closure or road closure that is required to be re-opened at a specific time), the same procedure can be applied, substituting hourly volumes and delays for daily values. If hourly volumes are not available, hourly delay costs can be estimated using the calculated daily RUC distributed on an hourly basis using a diurnal distribution.

B. Calculated Operating Costs

DelDOT has adopted the Red Book's module for calculating operating and ownership costs. Operating costs are calculated on a per mile basis based on the travel speed of the roadway on which the vehicle travels. Annually, the Traffic Safety Section, in consultation with Contract Administration, will determine the appropriate operating costs to be used for RUC calculation purposes based on the Consumer Price Index. In the yearly attachments found under the Road User Cost Analysis Design Guidance Memorandum, see Table Attachment for current operating cost values.

Operating costs are calculated only for detour routes. While operating costs may be incurred due to the additional delay associated with idling in a queue resulting from a lane closure, those costs are accounted for in the delay costs discussed previously. Using the information from Table Attachment, the additional daily (or hourly) operating costs resulting from a detour can be calculated using the following equation:

$$Daily\ Operating\ Cost =$$
$$ADT \times \%auto \times (D_{WZ} \times AOC_{WZ} - D \times AOC) + ADT \times \%truck \times (D_{WZ} \times TOC_{WZ} - D \times TOC)$$

Where:
ADT = average daily traffic
% auto = percentage of non-trucks in the traffic stream
D_{wz} = travel distance with the work zone in place
AOC_{wz} = operating cost per auto ($/mile) with the work zone in place from Table 2 Aattachment
D = travel distance without the work zone
AOC = operating cost per auto ($/mile) without the work zone from Table 2 Attachment
% truck = percentage of light and heavy trucks in the traffic stream
TOC_{wz} = operating cost per truck ($/mile) with the work zone in place from Table 2 attachment
TOC = operating cost per truck ($/mile) without the work zone from Table 2 Attachment

The percentages of trucks (light and heavy) can be estimated from available turning movement counts, from vehicle classification data from existing 24/7 traffic monitoring sites or by using the percentages for the appropriate Traffic Pattern Group as identified in DelDOT's annual Vehicle Volume Summary. Data from existing 24/7 traffic monitoring sites can be obtained by contacting the with access to the TMC Extranet or by contracting the DelDOT TMC. For the purposes of RUC calculations, a light truck is defined as a single unit truck with 3 or more axles, larger than a pick-up truck (includes buses). Heavy trucks are considered to be all tractor-trailer type vehicles. In the absence of data on light trucks, that value can be omitted from the calculation.

Hourly operating costs for a project are typically calculated on a daily basis using the procedure previously described. However, in some cases, hourly operating cost values will be required. In these cases (such as for an overnight lane closure or road closure that is required to be re-opened at a specific time), the same procedure can be applied, substituting hourly volumes and delays for daily values. If hourly volumes are not available, hourly operating costs can be estimated using the calculated daily RUC distributed on an hourly basis using a diurnal distribution.

C. Calculated Hourly or Daily RUC

The final calculated hourly or daily RUC is determined using the appropriate equations below. The actual cost value used in a contract may be less than the calculated daily user cost, as deemed appropriate by the Project Team that may include the following: administering construction section, Traffic Safety, Consultant (if a consultant-led project), and any other applicable parties.

$$Total\ Daily\ Road\ User\ Cost\ = Daily\ Delay\ Cost + Daily\ Operating\ Cost$$
$$Hourly\ Road\ User\ Cost = Hourly\ Delay\ Cost + Hourly\ Operating\ Cost$$

D. Application of RUC

RUCs should be calculated for each of the following scenarios if applicable to the project:

- Late opening of travel lanes for each impacted roadway within the Contract (based on the approved allowable lane closure hours) – these are calculated and presented as incremental hourly costs and applied every 15-minutes beyond the allowable lane closure hours.

- Late opening of roadways or ramps when the associated detour is implemented on a daily/nightly basis during allowable lane/road closure hours – these are calculated and presented as incremental hourly costs and applied every 15-minutes beyond the allowable closure hours.
- Late opening of roadways or ramps when the associated detour is implemented for a fixed number of calendar days – these are calculated and presented as daily costs and are applied daily beyond the allowable closure period.
- Interim project milestones, such as opening a portion of the project to traffic – these are calculated as daily costs and applied based on recommendations from the project's TMP.
- Overall project duration – these are calculated as daily costs and applied based on recommendations from the project's TMP or based on the project delivery type (typically used for projects that include A+B bidding).

Draft RUC calculations will be reviewed with other sections of the Department as part of the Maintenance of Traffic/Construction Phasing/Constructability meeting that occurs between the semi-final and final plan submission. RUC values should be rounded to the nearest $10.00. Prior to the submission of Plans, Specifications, & Estimates (PS&E) packages, the final RUC calculations should be submitted to the Traffic Safety Section as part of the Contract Work Hour Restrictions Checklist.

The design project manager will prepare language for the General Description detailing all RUCs and application of those costs for inclusion in the Contract. A template for the General Description language is maintained by Engineering Support and should be requested by the design project manager. Prior to submitting the PS&E package, the Project Team will review the language for the General Description and agree on the value of the RUC that will be included in the Contract. The agreement on the value of the RUC may consider making less, but cannot exceed the maximum calculated RUC when the contract is using Federal funds. Adjusting the RUC for the Contract may be considered for some of the following reasons: to make usable for the applied location, ensure the values are enforceable, or make the costs reasonable related to the overall project costs. The final General Description language will then be provided to Engineering Support as part of the project's PS&E submittal.

Application of RUCs on a project is made by informing Engineering Support to add the RUC special provision to the Contract. Engineering Support will include the RUC special provision in the Contract. The design project manager will ensure that the agreed upon General Description language is included in the front of the "bid package" and ensure that the RUC special provision is included in the Contract when reviewing the Contract prior to advertisement of the project.

E. Presentation of Road User Costs

E.1 RUCs for travel lane and road/ramp closures during allowable lane closure hours:

RUCs for travel lane closures are calculated based solely on the daily or hourly delay cost portion of the RUC calculation. RUCs for detours are calculated based on the total daily or hourly delay and operating costs. RUCs for hourly late opening scenarios are calculated for the first two hours after the lane or road is to be opened. The two-hour RUC is divided into 15-minute increments to assess fees for late opening. Beyond the initial two hours, the RUC accrues hourly at the amount of the initial late opening hourly rate. A full day of assessing RUCs is considered as 10 hours from the end of the allowable lane closure hours. Tables 1 and 2 provide

an example of RUC assessment when the lane or road closure extends beyond the allowable lane closure hours, utilizing 2022 delay cost values and 2% heavy trucks.

Table 1: Example Road User Costs for Late Opening of Travel Lanes

Time Period	Volume	Additional Time	RUC per Hour
7 AM – 8 AM	1,058	+6 minutes	$2,500
8 AM – 9 AM	1,125	+10 minutes	$4,300
Total 2-Hour RUC = $6,800			

7 AM thru 8 AM Hourly Delay Cost = (6/60) × (1058 × 0.98 × 22.76 + 1058 × 0.02 × 33.52)
8 AM thru 9 AM Hourly Delay Cost = (10/60) × (1125 × 0.98 × 22.76 + 1125 × 0.02 × 33.52)

Table 2: Example Road User Costs for Late Opening of Travel Lanes by 15-minute Periods

Time All Lanes Reopened After End of Allowable Lane Closure Hours	Road User Cost
1st 15-minute increment	$850
2nd 15-minute increment	$1,700
3rd 15-minute increment	$2,550
4th 15-minute increment	$3,400
5th 15-minute increment	$4,250
6th 15-minute increment	$5,100
7th 15-minute increment	$5,950
8th 15-minute increment	$6,800

**After the first two hours beyond the allowable lane closure hour limit, RUC will accrue at $850 per 15-minute, up to a day total of $34,000. The RUC values within the chart are not cumulative, payments made after the first two hours are.*

E.2 RUCs for full-time detours:

RUCs associated with late opening of roadways or ramps when the associated detour is implemented for a fixed number of days will be assessed daily until the roadway or ramp is reopened. The full daily RUC is assessed regardless of what time of day the roadway or ramp is reopened. For contracting purposes, the daily and hourly cost is provided in the Contract Documents. Table 3 provides an example of daily RUC assessment for a fixed calendar day duration detour. In this example, assume the duration of the closure is approved for 90 calendar days. Starting at 12:00 AM on day 91, the contractor is assessed a daily RUC of $17,000 for each day, or portion of a day, beyond 90 calendar days the roadway remains closed. If the contractor opens the road at 12:05 AM on day 91, by contract, the contractor would be assessed the full $17,000 RUC for that day.

Table 3: Example Road User Costs for Fixed Duration Detour

Movement	Detoured Volume	Additional Distance	Additional Time	RUC
NB Plantation Rd to US 9	1213	+ 5.3 miles	+ 8 minutes	$6,400
EB Beaver Dam Rd to Plantation Rd	926	+ 0.5 miles	+2 minutes	$900
SB SR 1 Plantation Rd	519	+0.6 miles	+ 1 minute	$400
NB SR 1 to Beaver Dam Rd	373	+1.7 miles	+ 2 minutes	$600
WB Lewes to Beaver Dam Rd	469	+1.7 miles	+ 2 minutes	$700
WB Lewes to Plantation Rd	2000	+2.5 miles	+ 5 minutes	$5,900
EB US 9 to Plantation Rd	1803	+0.9 miles	+ 2 minutes	$2,100
			Total	***$17,000***

Example: NB Plantation Road to US 9
Utilizing 2022 cost values (2% heavy trucks and a 45-mph speed limit)
Daily Delay Cost = (8/60) × (1213 × 0.98 × 22.76 + 1213 × 0.02 × 33.52)
Daily Operating Cost = 1213 × 0.98 × (5.3 × 0.453) + 1213 × 0.02 × (5.3 × 0.933)

V. Justification

The calculation of RUCs provides information enabling the design project manager to make better informed decisions regarding phasing, allowable lane or road closure hours, project delivery method, and the design itself. Application of RUC provides the administering construction section with tools to enforce the lane closure or road closure/detour requirements of a project minimizing the delay and operating cost incurred by the traveling public.

Prepared by: Traffic Safety — Date: 05/01/2026

Recommended by: Chief of Traffic Operations — Date: 05/26/2026

Attest to Form and Process: Support Engineer — Date: 7/6/2026

Recommended by: Deputy/Division Director — Date: 7/6/2026

Approved: Chief Engineer — Date: 07/10/2026

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