

→ 6.7.0 → Overview  
→ Overview → In 6.0 we had less reserving, Board member introduces a development technique that utilizes historical data on the relationship between paid claims & case reserves to assist reserve adequacy. Underwriting, "the future development method attempts to analyze the adequacy of case reserves based on the history of payments against those case reserves."

→ In this section, we begin by illustrating Board's case outstanding development technique, labeled as the outstanding technique #1.

→ We then discuss case outstanding technique #2, when development ratios to ultimate for case outstanding are estimated using benchmarks reported + paid claim development factors learned from industry sources.

## → 6.7.1 → Case Outstanding Technique #1

→ Assumptions & vars

→ There are two reserving techniques we will discuss that rely on using case outstanding to estimate unpaid claims. The first is simply referred to as case outstanding technique #1.  
→ Like many of the other reserving methods we've discussed, this technique is a variation of the development method. Instead of developing claims, we develop case outstanding & use the developed case outstanding to project claims. Since this technique relies on the development method, it has the same three key assumptions w/ the exception that the second assumption pertains to case outstanding instead of observed claims:

→) (This is recorded to date will continue to develop in a similar fashion to the future)

→) Case outstanding plus its returning increments are claims that have yet to be incurred

→) Throughout the policy period:

→ The paid claim types are static

→ Policy limits (if any) are static

→ Performance retention limits (if any) are static

→ There is constant claim processing (claims settlement rates & case outstanding adequacy)

→ In practice, actuaries do not use this technique often bc it implicitly assumes that future claims are related to claims that have already been reported (development of known claims rather than new claims), so paid claim rates come from claims prior to future unreported claims). For firms w/ business who write outstanding do not provide sufficient information on IBNR, this method is not appropriate.

→ Another disadvantage is that the rates used in technique #1 are somewhat difficult to interpret compared to development factors. Furthermore, since claims during the experience period can distort case outstanding which would, in turn, impact the unpaid claims estimates.

→ On the bright side, case outstanding technique #1 is great when most or all claims are reported during the first development period. It's fairly well w/ straight-line reserves w/ quarterly year analysis bc there is no prior IBNR.

→ Technique

→ As we alluded to, case outstanding technique #1 uses developed case outstanding to project unpaid claims. However, the case outstanding themselves are developed slightly differently. Before we start discussing the mechanism, we should first learn about these ratios:

→ The remaining-in-case ratio for a given age & maturity is the case outstanding at that maturity divided by the case outstanding for the previous maturity.

It is essentially the percent of the previous period's case outstanding that is "remaining".

$$\text{Remaining-in-case ratio} = \frac{\text{Ratio of case outstanding to previous case outstanding}}{\downarrow} = \frac{\text{Current case outstanding}}{\text{Prior case outstanding}}$$

→ The paid-on-case ratio for a given age & maturity is the incremental amount paid for that period divided by the case outstanding at the end of the previous period. This is essentially the percentage of the previous period's case outstanding that are paid this period.

$$\text{Paid-on-case ratio} = \frac{\text{Ratio of incremental paid claims to prior case outstanding}}{\downarrow} = \frac{\text{Paid-on-case claims}}{\text{Prior case outstanding}}$$

→ Notes → please note that the terms "Remaining-in-case" & "paid-on-case" are not explicitly mentioned in the source material. However, they have been used in the CAS past exam sample solutions.

→ Regarding the exam questions:

→ The "paid-on-case" ratio is commonly referred to as the "Ratio of incremental paid claims to previous case outstanding".  
→ The "remaining-in-case" ratio is also commonly referred to as the "Ratio of current case outstanding to previous case outstanding".

→ As you can see, "paid-on-case" & "remaining-in-case" are simply some convenient, functional ways to refer to these ratios.

→ Assuming we start w/ case outstanding & incremental paid claims factors, this method can be summarized in four steps:

→ 1) Calculate & select the remaining-in-case ratios for each maturity

→ 2) Project case outstanding w/ the selected remaining-in-case ratios

$$\text{Projected case outstanding} = \frac{\text{Selected remaining-in-case ratio}}{\text{Current case outstanding}} \times \text{Prior case outstanding}$$

(this is analogous to projecting claims under the development method.)

→ 3) Calculate & select the paid-on-case ratios for each maturity

→ 4) Project incremental payments using the selected paid-on-case ratios

$$\text{Projected incremental paid claims} = \frac{\text{Selected paid-on-case ratio}}{\text{Paid-on-case ratio}} \times \text{Prior case outstanding}$$

→ The ratios used in this method can be calculated or projected, but the project is similar to other reserving methods you have seen before. We will clarify using the example below. The example is similar to what you will encounter in past CAS exam questions.

→ Examples

→ You are given:

Accident Year	Case Outstanding (\$000)			
	12 Months	24 Months	36 Months	48 Months
2020	1,000	600	200	100
2021	1,050	630	220	
2022	1,100	650		
2023	1,150			

Accident Year	Cumulative Paid Claims (\$000)			
	12 Months	24 Months	36 Months	48 Months
2020	750	1,200	1,640	1,760
2021	800	1,275	1,730	
2022	880	1,380		
2023	940			

The 48-to-ultimate paid claim to prior case outstanding development factor is 1.1.

Create an incremental paid claims triangle. Then, estimate the ultimate claims for each accident year using the case outstanding development technique.

→ 1) Create an incremental paid claims triangle

→ To create an incremental paid claims triangle from a cumulative paid claims triangle:

→ Start w/ the cumulative triangle where each cell shows total payments up to each development period.

→ Calculate incremental payments by taking the difference between consecutive cumulative values w/ each step. For each cell, subtract the cumulative value at the prior development period from the current period.

→ For the first period in each step, the incremental value is the same as the cumulative amount.

→ This results in an incremental triangle, showing payments made in each specific period:

Accident Year	Incremental Paid Claims (\$000)			
	0 to 12 Months	12 to 24 Months	24 to 36 Months	36 to 48 Months
2020	750	450	440	120
2021	800	475	455	
2022	880	500		
2023	940			

→ b) Use the case outstanding technique

→ Step 1: Calculate & select remaining-in-case ratios

→ We can find the remaining-in-case ratios for each increment using the equation above. By the provided case outstanding information, divide each cell's value by the value to its left immediately to its left. Then we'll need to compute.

Accident Year	Remaining-in-Case Ratios (a.k.a. Ratio of Case Outstanding to Previous Case Outstanding)			
	12 to 24 Months	24 to 36 Months	36 to 48 Months	
2020	600 / 1,000 = 0.600	440 / 600 = 0.733	120 / 200 = 0.600	
2021	630 / 1,050 = 0.600	220 / 630 = 0.349		
2022	650 / 1,100 = 0.591			
Average	0.597	0.341	0.500	

→ The ratios used in this method can be calculated or projected, but the project is similar to other reserving methods you have seen before. We will clarify using the example below. The example is similar to what you will encounter in past CAS exam questions.

→ Step 2: Project case outstanding

→ For each age & maturity, multiply the remaining-in-case ratios by the prior case outstanding to project the case outstanding.

The completed triangle is depicted below.

Accident Year	Case Outstanding (\$000)			
	12 Months	24 Months	36 Months	48 Months
2020	1,000	600	200	100
2021	1,050	630	220	
2022	1,100	650		
2023	1,150			

→ Step 3: Calculate & select paid-on-case ratios

→ For each year & maturity, calculate the paid-on-case ratios using the equation above. Divide the incremental paid claims in each development period by the case outstanding at the beginning of that period. The ratios appear to be stable across development periods, allowing us to select one average ratio for each maturity.

Accident Year	Paid-on-Case Ratios (a.k.a. Ratio of Incremental Paid Claims to Previous Case Outstanding)			
	12 to 24 Months	24 to 36 Months	36 to 48 Months	
2020	450 / 750 = 0.600	440 / 600 = 0.733	120 / 200 = 0.600	
2021	475 / 800 = 0.593	455 / 630 = 0.722		
2022	500 / 880 = 0.568			
Average	0.597	0.550	0.667	

→ The ratios used in this method can be calculated or projected, but the project is similar to other reserving methods you have seen before. We will clarify using the example below. The example is similar to what you will encounter in past CAS exam questions.

→ Step 4: Project incremental payments

→ This involves multiplying the given incremental paid claims table, multiply each cell by the prior year's case outstanding.

→ Don't forget about the 48-to-ultimate paid-on-case factor of 1.1! The completed triangle is depicted below.

Accident Year	Incremental Paid Claims (\$000)			
	0 to 12 Months	12 to 24 Months	24 to 36 Months	36 to 48 Months
2020	450	290	160	80
2021	475	315	180	90
2022	500	340	200	100
Average	475	310	180	90

→ Finally, sum the incremental paid