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National Indian Gaming Commission

Comparison Analysis of Various Class II

Configuration Options

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Appendix A: Configuration Experiments / Options / Results

1   INTRODUCTION

BMM North America (BMM) has been asked by the National Indian Gaming Commission (NIGC) to develop a Bingo simulator that could represent Class II Bingo games. The simulator has a number of parameters that enable the game to be customized.

The NIGC also asked BMM to run a number of simulations with nominated parameters which match various options under consideration. These simulations have been run and this report is a summary of the findings of the simulation. The results are provided without comment. Note that Appendix A contains a full description of the parameters and options used during the simulation runs and their outcomes.

2   DESCRIPTION OF THE SIMULATOR PARAMETERS

The following table, which has been extracted from Appendix A, describes the various parameters available with the simulator.

Description	Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
Time between games	1000	1000		1000	1000		1000	1000
Time to wait for all players	2000	2000		2000	2000		2000	2000
Time for first ball release	2000	2000		2000	2000		2000	2000
Time to wait for first cover	2000	2000		2000	2000		2000	2000
Time for second ball release	2000	2000		2000	2000		2000	2000
Time for final claim	2000	2000		2000	2000		2000	2000
Time for fast start	N/A	N/A		12	2000		12	2000
Number Players	2	2		6	6		2	12
Fast Start / Duration	6	720		13	720		6	720
Games / Coin In	3762	4159600		4118	6893712		3981	6553310
Games & Coin In Rate	5.23	5777.22		5.72	9574.6		5.53	9101.82
Comparison				9.46%			5.82%	

1) The Time parameters are fairly self explanatory. Their units are milliseconds. Thus the Time Between Games for all of the experiments in the above table is 1,000 milliseconds or one second.

2) Where the Minimum and Maximum values are different, a random number is selected within their range, inclusively.

3) The number of players represents those to participate in each Bingo game simulation. The first pair of columns is two players in each game and the second pair six players in each game. The third pair represents that a random number of players between two and twelve will participate in each game.

4) The Fast Start parameter is used to reflect that a Bingo game under the current Classification Standards may commence "early" if there are six or more players within the game, otherwise the game would need to wait a full two seconds to start (the Time to wait for all players). In these experiments, the Fast Start parameter was a variable between 12 milliseconds and two seconds reflecting a real life variability in players starting the next play.

5) The duration is the time for which the experiment was run – in the table above, it was 720 minutes or 12 hours.

6) The outputs of the simulation are the number of Games played during the simulation run and the Coin In obtained for that simulation.

7) These two outputs are converted to a rate per minute by dividing the result by the elapsed time. We have chosen the Games played as the most meaningful statistic in the comparisons made during this report. Thus the Games per Minute for the three experiments show Game Play rates of 5.23, 5.72 and 5.53 respectively.

8) The comparisons will vary between experiments but represent a percentage of Games Played for one criteria versus Games Played for another criteria. In the table above, the comparisons show a 9.46% higher Game Play rate for six players in a game and 5.82% greater game play rate for variable 2 to 12 players in a game.

3 COMPONENTS

3.1 Bingo Game Templates

There are three Bingo game templates described in detail in Appendix A. The following is a brief description of each of the three templates:

1) "Compliant" – parameters that reflect the current state of the Classification Standards.

2) "Consensus" – parameters that reflect games that were the subject of Class II classification opinions by the NIGC General Counsel.

3) "One Touch" – the most commonly implemented parameters for current Class II equipment.

3.2 Experiments

There were four experiments requested to be run which are described in Appendix A.

1) A comparison of the effect of the "Fast Start" option for Compliant Games i.e. game that would start faster if six or more players are rapidly playing in each game. The rate or play for getting all players active in the compliant game was set randomly in the range of 12 to 2000 milliseconds where appropriate, perhaps more closely resembling what might happen in real life.

2) A comparison of the outcome, Games Played, of the Compliant Games versus the outcome of the Consensus games. The rate of play for getting all players active in a Consensus Game was set uniformly as one second.

3) A comparison of the outcome, Games Played, of the Compliant games versus the outcome of the One Touch games. The rate of play for getting all players active in a game was also set randomly in the range of 12 to 2000 milliseconds where appropriate, perhaps more closely resembling what might happen in real life.

4) A comparison of the Compliant Games versus both Consensus Games and One Touch Games in a simulation of less and less play in the game within the casino. This has been structured to represent a range of times between games as a means to broadly emulate the out of hours performance of a typical casino.

4   RESULTS

The following is a brief summary of the results of these experiments for which details are contained within the various Tables within Appendix A.

4.1 Experiment 1

This experiment performed a comparison of the performance effect of the "Fast Start" option for Compliant Games i.e. in situations when there are six or more players in a game, it may start immediately rather than wait the full two seconds. The outcome of the comparisons from this experiment show a 20.46% higher Game Play rate for six players versus two players in a game and 16.25% greater game play rate for variable 2 to 12 players in a game also versus two players. In absolute terms, for the 12 hours of the simulation experiment, the results showed 3,762 games played with two players per game, 4,118 games played with six players per game and 3,981 games played with a variable number of players per game ranging between 2 and 12. The reason that the variable 2 to 12 players is a lower rate than the six players per game is because in circumstances where five or less players join in a game, there must be a full two seconds wait for the game to start, whereas with six fixed, that component of the waiting can be dramatically reduced.

4.2 Experiment 2

This experiment performed a comparison of the performance of the Compliant Games versus the performance of the Consensus Games. The outcome of the comparison of the three runs, based upon number of active players in a game, show a percentage increase of about 75%, 60% and 65% in games played per minute for the Consensus Games when compared with the Compliant Games. In absolute terms, for the 12 hours of the simulation experiment, the results showed 3,762 versus 6,583 games played with two players per game, 4,118 versus 6,570 games played with six players per game and 3,981 versus 6,568 games played with a variable number of players per game ranging between 2 and 12 with the former figure the Compliant Game results and the latter figure the Consensus Game results for each of the three comparisons.

4.3 Experiment 3

This experiment performed a comparison of the performance of the Compliant Games versus the performance One Touch Games. The outcome of the comparison of the three runs, based upon number of active players in a game, show a percentage increase of about 152%, 130% and 137% in games played per minute for the One Touch Games when compared with the Compliant Games. In absolute terms, for the 12 hours of the simulation experiment, the results showed 3,762 versus 9,474 games played with two players per game, 4,118 versus 9,457 games played with six players per game and 3,981 versus 9,452 games played with a variable number of players per game ranging between 2 and 12 with the former figure the Compliant Game results and the latter figure the One Touch Game results for each of the three comparisons.

4.4 Experiment 4

This experiment performed a comparison of the performance of the Compliant Games versus the performance of both the Consensus and One Touch Games in a simulation of less and less play in the game within the casino. The outcome of this experiment is shown in Table D in the Appendix and shows a diminishing effect of the rules and timing variations as the utilization diminishes, ranging from 57% down to 5.7% for the Consensus Game versus the Compliant Game and 112% down to 9.2% for the One Touch Game versus the Compliant Game. Appendix A also contains graphs which summarize the output.

4.5 Experiment 5 Consensus versus One Touch

As an extra analysis, we show in Appendix A the outcome of a comparison of simulation runs for one consistent set of parameters of the Consensus versus One Touch game. This shows an improvement of 42.5% for the latter over the former. In absolute terms, for the 12 hours of the simulation experiment, the results showed 6,583 versus 9,374 games played with the former figure the Consensus Game results and the latter figure the One Touch Game results.

5 EFFECT OF THE GAME WINNING PRIZE

The Classification Standards establish a minimum prize for the game winning prize which is to be 20% of the wager placed or one cent, whichever is greater. This can cause a high degree of variability of player return depending upon the number of players in the game. The following table shows these variations with the vertical column showing the number of players within a game and the horizontal the effect of the game winning prize at various percentages. (The table assumes that there will be bets that are a direct multiple of the percentage.

Players	1	2	3	4	5	8	10	12	15	20
2	0.5000	1.0000	1.5000	2.0000	2.5000	4.0000	5.0000	6.0000	7.5000	10.0000
3	0.3333	0.6667	1.0000	1.3333	1.6667	2.6667	3.3333	4.0000	5.0000	6.6667
4	0.2500	0.5000	0.7500	1.0000	1.2500	2.0000	2.5000	3.0000	3.7500	5.0000
5	0.2000	0.4000	0.6000	0.8000	1.0000	1.6000	2.0000	2.4000	3.0000	4.0000
6	0.1667	0.3333	0.5000	0.6667	0.8333	1.3333	1.6667	2.0000	2.5000	3.3333
7	0.1429	0.2857	0.4286	0.5714	0.7143	1.1429	1.4286	1.7143	2.1429	2.8571
8	0.1250	0.2500	0.3750	0.5000	0.6250	1.0000	1.2500	1.5000	1.8750	2.5000
9	0.1111	0.2222	0.3333	0.4444	0.5556	0.8889	1.1111	1.3333	1.6667	2.2222
10	0.1000	0.2000	0.3000	0.4000	0.5000	0.8000	1.0000	1.2000	1.5000	2.0000
11	0.0909	0.1818	0.2727	0.3636	0.4545	0.7273	0.9091	1.0909	1.3636	1.8182
12	0.0833	0.1667	0.2500	0.3333	0.4167	0.6667	0.8333	1.0000	1.2500	1.6667
Delta	0.4167	0.8333	1.2500	1.6667	2.0833	3.3333	4.1667	5.0000	6.2500	8.3333

As can be seen there is a large variability at 20% depending upon the number of players who participate in a game. The payout table used was 89.1% for the bonus prizes which would mean a variation in player return between 90.8% and 99.1% depending upon the number of players in the game.

Appendix A

Configuration Experiments / Options / Results

The following experiment / configuration options were used for the various simulation experiments conducted by BMM:

1. Measure variability in games played and coins handled within the compliant "three-touch" game itself.

Constants:

Time between games =1,000 ms

Time for first ball release = 2,000 ms

Time for first cover = 2,000 ms

Time for second ball release = 2,000 ms

Time for final claim all = 2,000 ms

Wager size = 1 (100) to 10 (1,000) coins, random.

Variables in different simulations:

A. Assume two players at all times.

Time to wait for all players = 2,000 ms

B. Assume six players at all times.

Time to wait for all players = 12 ms to 2,000 ms, random.

C. Assume 2 - 12 players.

Time to wait for all players = 2,000 ms, unless Number of players > 5, in which case time to wait for all players = 12 ms to 2,000 ms, random.

Results:

For this comparison experiment, the time to start the game is variable between 12 and 2,000 milliseconds representing a medium pace of game play. With the compliant game, if there are less than 6 players, the full two seconds is the time between games.

Table A

Description	Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
Time between games	1000	1000		1000	1000		1000	1000
Time to wait for all players	2000	2000		2000	2000		2000	2000
Time for first ball release	2000	2000		2000	2000		2000	2000
Time to wait for first cover	2000	2000		2000	2000		2000	2000
Time for second ball release	2000	2000		2000	2000		2000	2000
Time for final claim	2000	2000		2000	2000		2000	2000
Time for fast start	N/A	N/A		12	2000		12	2000
Number Players	2	2		6	6		2	12
Fast Start / Duration	6	720		13	720		6	720
Games / Coin In	3762	4159600		4118	6893712		3981	6553310
Games & Coin In Rate	5.23	5777.22		5.72	9574.6		5.53	9101.82
Comparison				9.46%			5.82%	

2. Measure difference in games played and coins handled between compliant three-touch game and game meeting requirements of Consensus ("Consensus game").

Constants:

Consensus Game:

Time between games = 1,000 ms

Time to wait for all players = 1,000 ms

Time for first ball release = 10 ms

Time for first cover = 2,000 ms

Time for second ball release = 10 ms

Time for final claim = 2,000

Wager size = 1 (100) to 10 (1,000) random.

Compliant Game:

Time between games = 1,000 ms

Time for first ball release = 2,000 ms

Time for first cover = 2,000 ms

Time for second ball release = 2,000 ms

Time for final claim = 2,000

Wager size = 1 (100) to 10 (1,000) random.

Variables in different simulations:

A. Assume two players at all times in both games.

Time to wait for all players in compliant game = 2,000 ms

B. Assume six players at all times in both games.

Time to wait for all players in compliant game = 12 ms to 2,000 ms, random.

C. Assume 2 - 12 players in both games.

Time to wait for all players = 2,000 ms, unless Number of players > 5, in which case time to wait for all players = 12 ms to 2,000 ms, random.

Results, Consensus Game – see Table A in section 1. for results of Compliant Game.

Table B

Description	Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
Time between games	1000	1000		1000	1000		1000	1000
Time to wait for all players	1000	1000		1000	1000		1000	1000
Time for first ball release	10	10		10	10		10	10
Time to wait for first cover	2000	2000		2000	2000		2000	2000
Time for second ball release	10	10		10	10		10	10
Time for final claim	2000	2000		2000	2000		2000	2000
Time for fast start	N/A	N/A		N/A	N/A		N/A	N/A
Number Players	2	2		6	6		2	12
Fast Start / Duration	6	720		7	720		13	720
Games / Coin In	6583	7180000		6570	10976500		6568	10717890
Games & Coin In Rate	9.14	9972.22		9.13	15245.14		9.12	14885.96
Comparison	74.76%			59.54%			64.98%	

3. Measure difference in games played and coins handled between compliant three-touch game and one-touch game.

Constants:

One-Touch Game:

Time between games = 1,000 ms

Time to wait for all players = 12 ms to 2,000 ms, random

Time for first ball release = 10 ms

Time for first cover = 10 ms

Time for second ball release = 10 ms

Time for final claim = 2,000

Wager size = 1 (100) to 10 (1,000) random.

Compliant Game:

Time between games = 1,000 ms

Time for first ball release = 2,000 ms

Time for first cover = 2,000 ms

Time for second ball release = 2,000 ms

Time for final claim = 2,000

Wager size = 1 (100) to 10 (1,000) random.

Variables in different simulations:

A. Assume two players at all times in both games.

Time to wait for all players in compliant game = 2,000 ms

B. Assume six players at all times in both games.

Time to wait for all players in compliant game = 12 ms to 2000 ms, random.

C. Assume 2 - 12 players in both games.

Time to wait for all players in compliant game = 2,000 ms, unless Number of players > 5, in which case time to wait for all players = 12 to 2000 ms, random.

Results, One Touch – See Table A In Section 1. for results of Compliant Game.

As for the compliant game, the time to start the game is variable between 12 and 2,000 milliseconds representing a medium pace of game play.

Table C

Description	Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
Time between games	1000	1000		1000	1000		1000	1000
Time to wait for all players	12	2000		12	2000		12	2000
Time for first ball release	10	10		10	10		10	10
Time to wait for first cover	10	10		10	10		10	10
Time for second ball release	10	10		10	10		10	10
Time for final claim	2000	2000		2000	2000		2000	2000
Time for fast start	N/A	N/A		N/A	N/A		N/A	N/A
Number Players	2	2		6	6		2	12
Fast Start / Duration	6	720		7	720		13	720
Games / Coin In	9474	10347600		9457	15856310		9452	15517050
Games & Coin In Rate	13.16	14371.67		13.13	22022.65		13.13	21551.46
Comparison	151.63%			129.55%			137.43%	

4. Measure effect of casino not operating at capacity - change in difference in games played and coins in between the One Touch Games, Consensus Games and Compliant Games when time between games increases.

Constants:

Consensus Game:

Number of players = 2 to 12, random

Time to wait for all players = 1,000 ms

Time for first ball release = 10 ms

Time for first cover = 2,000 ms

Time for second ball release = 10 ms

Time for final claim = 2,000

Wager size = 1 (100) to 10 (1,000) random.

Complaint Game:

Number of players = 2 to 12, random

Time to wait for all players = 1,000 ms

Time for first ball release = 2,000 ms

Time for first cover = 2,000 ms

Time for second ball release = 2,000 ms

Time for final claim = 2,000

Wager size = 1 (100) to 10 (1,000) random.

One-touch Game:

Number of players = 2 to 12, random

Time to wait for all players = 1,000 ms

Time for first ball release = 10 ms

Time for first cover = 10 ms

Time for second ball release = 10 ms

Time for final claim = 2,000

Wager size = 1 (100) to 10 (1,000) random.

Variables in different simulations:

The following table shows the various time between games experiments that were run.

Experiment	Time Between Games	Experiment	Time Between Games	Experiment	Time Between Games
A.	60,000 ms	B.	50,000 ms	C.	40,000 ms
D.	30,000 ms	E.	20,000 ms	F	15,000 ms
G.	10,000 ms	H.	8,000 ms	I.	6,000 ms
J.	4,000 ms	K.	2,000 ms		

Game Parameters

The following table shows the game parameters used during these experiments:

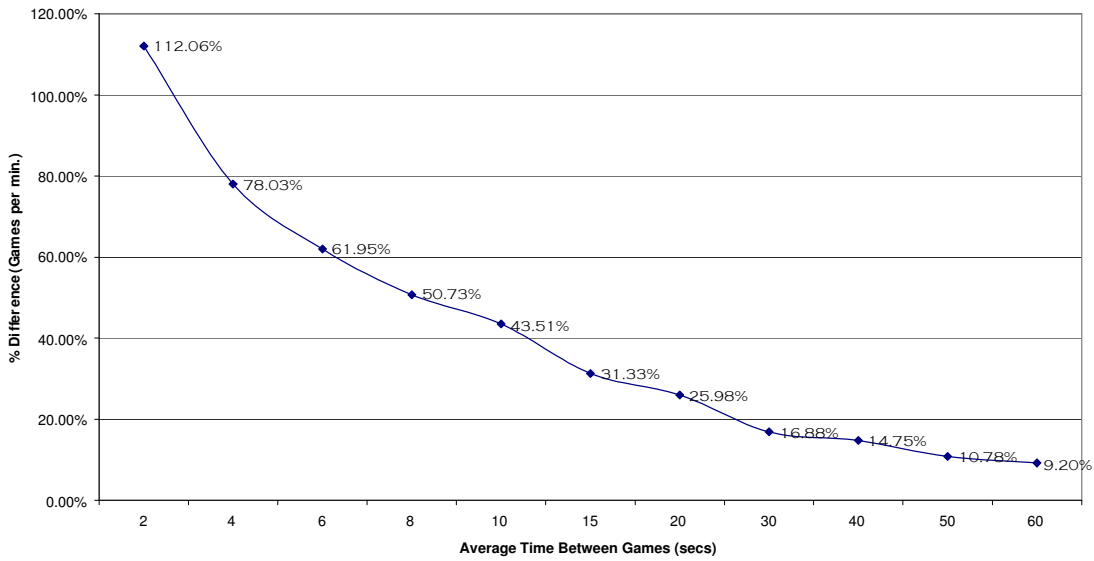| Description	Compliant Game			Consensus Game			One Touch Game	
	Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
Time between games	Variable	Variable		Variable	Variable		Variable	Variable
Time to wait for all players	1000	1000		1000	1000		1000	1000
Time for first ball release	2000	2000		10	10		10	10
Time to wait for first cover	2000	2000		2000	2000		10	10
Time for second ball release	2000	2000		10	10		10	10
Time for final claim	2000	2000		2000	2000		2000	2000

Results:

The following table shows the results comparison of games per minute for each of the Experiments for the three different games:
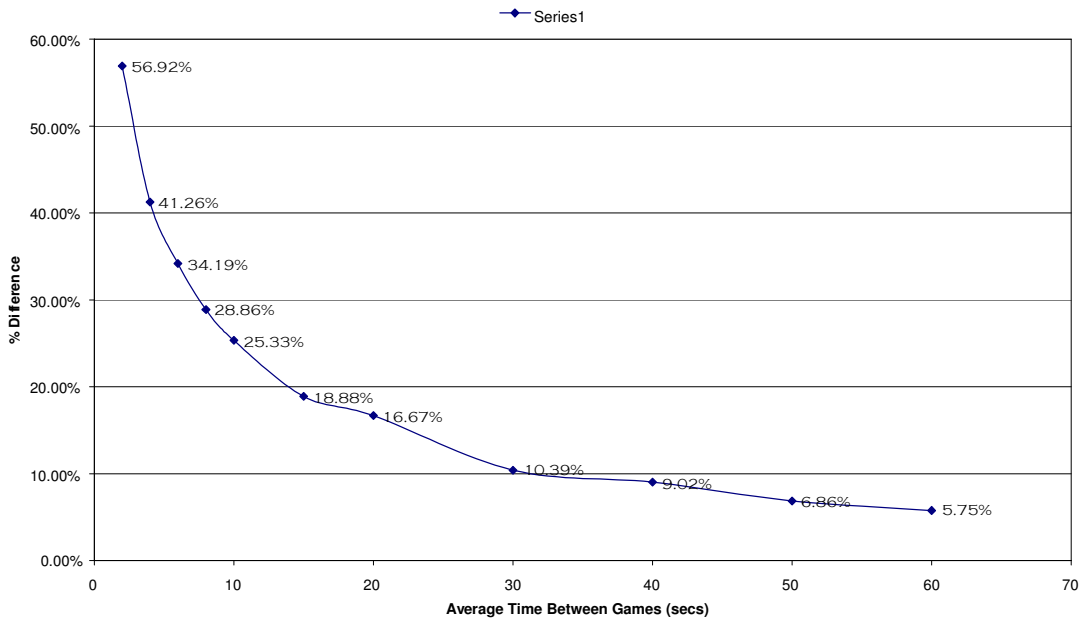
Table D

Time Between	Compliant	Consensus	Ratio Consensus	One Touch	Ratio One Touch
2,000	5.06	7.94	56.917%	10.73	112.055%
4,000	4.46	6.30	41.256%	7.94	78.027%
6,000	3.89	5.22	34.190%	6.30	61.954%
8,000	3.43	4.42	28.863%	5.17	50.729%
10,000	3.08	3.86	25.325%	4.42	43.506%
15,000	2.49	2.96	18.876%	3.27	31.325%
20,000	2.04	2.38	16.667%	2.57	25.980%
30,000	1.54	1.70	10.390%	1.80	16.883%
40,000	1.22	1.33	9.016%	1.40	14.754%
50,000	1.02	1.09	6.863%	1.13	10.784%
60,000	0.87	0.92	5.747%	0.95	9.195%

The following are graphical views of the above data where the X axis represents the average time between games and the Y axis the percentage difference between the Compliant Game and the One Touch and Consensus Games respectively.

Compliant Games vs. One-Touch Games

Compliant Games vs. Opinion Games

5. Additional Experiment

Consensus versus One Touch

The following is a comparison of simulation runs for one consistent set of parameters of the Consensus versus One Touch game.

Table E

Description	Minimum	Maximum		Minimum	Maximum
Time between games	1000	1000		1000	1000
Time to wait for all players	1000	1000		1000	1000
Time for first ball release	10	10		10	10
Time to wait for first cover	10	10		2000	2000
Time for second ball release	10	10		10	10
Time for final claim	2000	2000		2000	2000
Time for fast start	N/A	N/A		N/A	N/A
Number Players	2	12		2	2
Fast Start / Duration	13	720		6	720
Games / Coin In	9374	15333690		6583	7180000
Games & Coin In Rate	13.02	21296.79		9.14	9972.22
Comparison	42.45%				